ARMY R,D&A

- RESEARCH
- DEVELOPMENT
- ACQUISITION

MAY - JUNE 1985

ARMY LABS MOVING INTO THE FUTURE

ARMY R,D&A

Vol. 26 No. 3 MAY-JUNE 1985

OFFICIAL MAGAZINE OF THE RDA COMMUNITY, established 1959

ABOUT THE COVER:

The front cover, which relates to a number of articles in this issue on the Army's in-house laboratory system, symbolizes the progressive advancements provided to the Army as a result of laboratory research and technology efforts. The back cover is associated with an article describing major changes in the conduct of Army operational testing and evaluation. Cover designed by Christine Deavers, AMC Graphics Section.

FEATURES

DEPARTMENTS

DISTRIBUTION is based on requirements submitted on DA Form 12-5. Army agency requirements must be mailed to the U.S. Army AG Publications Center, 2800 Eastern Boulevard, Baltimore, MD 21220.

Distribution on an individual basis is restricted to active and reserve officers who hold initial or additional specialties of R&D (51), Nuclear Energy (52), or Procurement (97), or an additional skill identifier of 6T.

CHANGE OF ADDRESS. Individual addresses are provided by Officer Military Personnel Center, Alexandria, VA, and the USARPC, St. Louis, MO. Where active officer addresses are incorrect, individuals should contact their respective officer personnel office to ensure forwarding of correct address. Reservists should contact USARPC, ATTN: AGUZ-OEPMD, St. Louis, MO 63132.

OTHER GOVERNMENT AGENCIES requirements should be submitted directly to U.S. Army Materiel Command, ATTN: AMCDE-XM, 5001 Eisenhower Ave., Alexandria, VA 22333.

FOR SALE BY the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

(USPS-584-330)

Army R,D&A (ISSN 0162-7082) (Vol. 26, No. 3) is an official Army periodical published bimonthly by HQ U.S. Army Materiel Command (AMC), Alexandria, VA 22333, under sponsorship of the Assistant Secretary of the Army (Research, Development & Acquisition); the Deputy Chief of Staff for Research, Development and Acquisition, Department of the Army; and the Commander, AMC.

Purpose: To provide a channel of communication among all members of the Army RD&A community and other government RD&A agencies; to promote the interchange of ideas and further the understanding of the RD&A process and RD&A management philosophy.

Picture Credits: Unless otherwise indicated, all photographs are from U.S. Army sources.

Submission of Material: All articles submitted for publication must be channeled through the technical liaison or Public Affairs Officer at installation or command level.

Bylined Articles: Primary responsibility for opinions of bylined authors rests with them; their views do not necessarily reflect official policy or position of Department of the Army.

Second class official mail postage paid by the United States Army at Alexandria, VA, and at additional mailing office. Forward copies per Domestic Mail Manual part 159.225. Use of funds for printing this publication has been approved by the Secretary of the Army on 19 February 1985 in accordance with the provisions of AR 310-1. POSTMASTER: Send address changes to *Army RD&A Magazine*, 5001 Eisenhower Avenue, Alexandria, VA 22333.

In Search of Excellent Army Laboratories

By Dr. Richard L. Hartman and Dr. Richard G. Rhoades

Introduction

Elsewhere in this issue are examples of excellent work by Army laboratories. But, almost every year, there is a new study to solve the "lab problem." We clearly need to improve the world's perception of the excellence we do have, and we need to become even more excellent. This paper summarizes a 1984 Army Science Conference presentation which discussed some views held by Army managers on excellence in laboratories.

One of the currently popular books concerned with performance is "In Search of Excellence," by Thomas J. Peters and Robert H. Waterman Jr. In their study, Peters and Waterman conclude that there are eight main attributes of excellent corporations: bias for action; close to the customer; autonomy and entrepreneurship; productivity through people; hands on, value driven; stick to the knitting; simple form — lean staff; and simultaneous loose-tight properties.

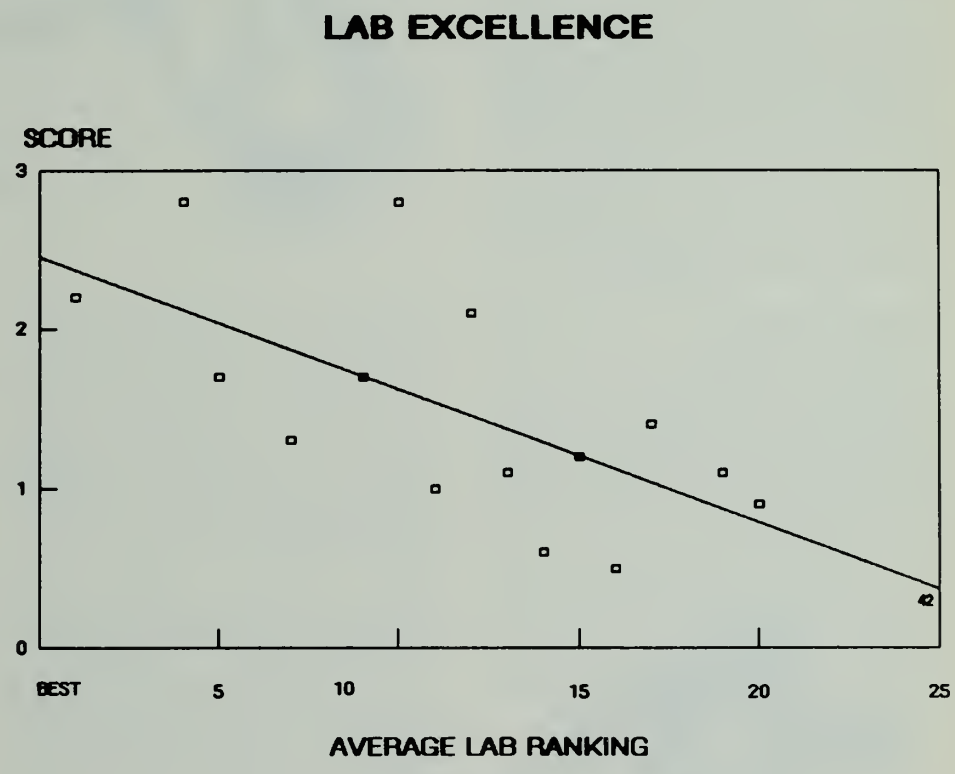


Figure 1.

Results

Although some researchers have questioned Peters and Waterman's methodology, the fundamental issue is whether the conclusions of the book provide helpful insight for government laboratory managers. In 1984 we surveyed Army lab managers to see if they thought the book gives useful guidance for Army labs. The survey focused on the above eight attributes and asked the managers to evaluate, on a sliding scale, if their lab should have those attributes and to what degree it did have the attributes. The managers overwhelmingly agreed that the attributes of excellent companies were highly applicable to Army labs. There was a wide range of opinion about the extent to which these attributes were currently present.

It is hard to evaluate the excellence of a lab. One composite measure is the Army Lab of the Year Award. Figure 1 shows the comparison between the 10 year average lab ranking in this competition and the degree to which the lab managers felt their labs possessed the attributes (3 = strongly agree; 0 = neutral). Clearly the better labs think they already enjoy these attributes.

A Bias for Action

The excellent companies were found to demonstrate a marked bias for action. The majority of Army lab managers agreed that our labs should have this attribute, but a few managers felt a bias for action could just get them into trouble. On the average, the managers thought the attribute was present, but there was a wide range of opinion.

One way to measure a bias for action is to count the number of memoranda, notes, conversations or other communications with respect to whether or not they encouraged action. We did a limited count and found that in the lab we selected, less than five percent of the "messages" in the system promoted a "bias for action." Engineers and scientists in the labs need to realize that the Army truly cares about action and productivity. On the other hand, Army management must continually express its desire for action, and should support that desire by realizing that every new restriction and piece of red tape not only competes with productive work, but

send the wrong message about what is important.

Close to the Customer

The excellent companies are very close to their customers (Figure 2). Research engineers place sales calls. Some food companies call on every customer every day. The Army managers we surveyed think this closeness is important, that the labs try hard, but that they need to do even better. Applying this principle is difficult. Unlike the child who spends his own money for a candy bar and then consumes it, we have one organization making the decision, another providing the money, and a third actually using our products. The scientist or engineer who worries about the individual soldier cannot go far wrong. But, understanding the diverse and complex nature of our customer is critical to excellence.

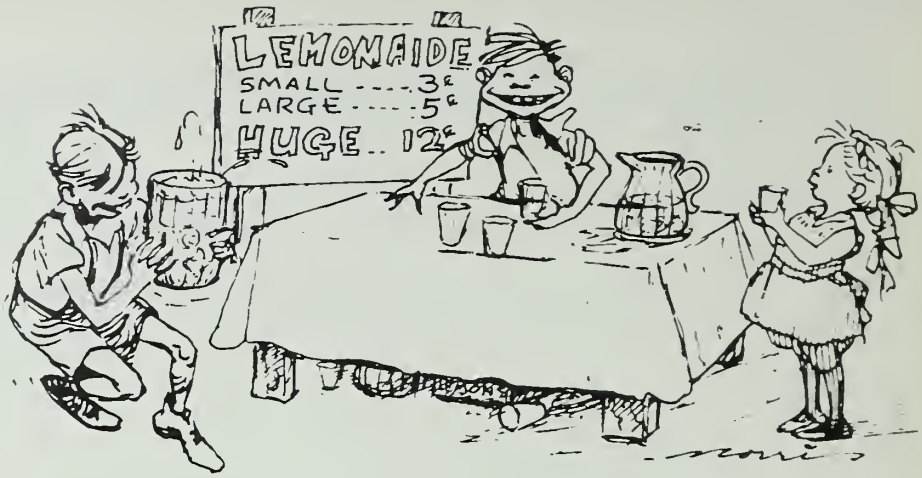


Figure 3.

Autonomy and Entrepreneurship

The excellent companies foster innovation and encourage risk taking (Figure 3). While most managers agreed that Army labs should have this attribute, some disagree with risk taking. They believe the Army is more concerned with avoiding failure than with innovation. The managers are somewhat concerned that our labs are not as innovative as they should be. Since there is clearly good work coming out of the labs, this leads to the next point.

Figure 2.

Productivity Through People

The excellent companies get high productivity from all their employees. In comparison, Army managers frequently speak of the 80 - 20 law: 80 percent of the work is done by 20 percent of the people. Excellent companies do not settle for this. Consider how much more productive we could be if all our work force was highly productive.

The Army managers thought the labs should and do have this attribute. We (the authors) are less convinced, because of our own studies of excellent labs and discussions with managers of excellent companies. The intensity of the people orientation at a company like Tandem Computers [see page 16] is far beyond anything we have seen in the Army. Currently, the government's Office of Personnel Management is proposing to reduce the quality of life in the government until the turnover rate exceeds that of industry. Instead, they should look at the turnover rate of the excellent companies, and try to emulate that.

Nevertheless, there is a lot that lab managers and scientists and engineers can do. Maximize your own contribution and do not accept shoddy or lazy work — on the other hand, reward good work.

Hands on, Value Driven

The excellent companies are run by people who know what they are doing. The companies have values, and those values are communicated to the workforce.

What are the values of the Army laboratory system — or of your lab? Does your organization value innovation? How many managers have innovation in their performance standards? Does your organization value cost control?

Too often we assume expertise exists where it really doesn't. Recently, one of us learned that not only did his wife not know what a fan belt was, no one in the family knew how to open the hood of the car. How many lab employees are in the same boat? Are you familiar with Army problems and with the hardware your command supports? Asking that question in our lab led to an exodus to our test range to observe some missile firings.

Stick to the Knitting

Peters and Waterman found that the excellent companies make money doing what they do best. They did not follow the trend to wild diversification.

The Army managers had a wide range of opinion about this attribute perhaps because they widely interpreted the principle involved. A lab cannot "stick to the knitting" if that means doing nothing new. But, if it means doing research well

Figure 4.

if that is your speciality, doing project support well if that is your speciality, we think the attribute applies. There is evidence that Army labs which haven't been in the system development business have made a mess of trying to get into that business. Laboratories have had difficulties when trying to act as procurement agencies.

Simple Form — Lean Staff

The excellent companies have a straightforward organization and small central staffs. It is not unusual for a multinational corporation to have a staff of less than 100. In his turnaround of Chrysler, Lee Iacocca had to greatly reduce the corporate staff as a money saving measure. He found that the smaller staff actually got the job done better!

The Army managers agree with the value of this attribute. Considering laboratory staffs, command staffs, Army Materiel Command (AMC) staff, DA staff, and DOD staff, much comment on this subject would be like shooting fish in a barrel. This is one area where the Army could learn from the excellent companies.

Simultaneous Loose-Tight Properties

Peters and Waterman describe a tight control of adherence to the values of the corporation, with a simultaneous loose control over the way the job gets done (figure 4).

The survey respondents had a wide range of opinion, which may reflect lack of understanding of the attribute. Right now, top leaders in the Office of the Deputy Chief of Staff for Research Development and Acquisition and AMC are vigorously trying to improve the clarity and understanding of values for the lab system. They also are trying to loosen the laboratory staff from some administrative shackles.

Conclusion

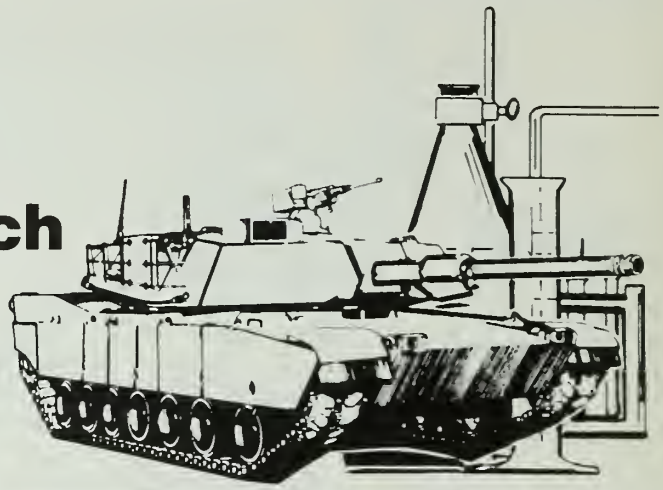
The survey showed that Army managers think the attributes of "In Search of Excellence" are appropriate for excellent Army labs. They also think that those attributes are present to a significant degree. But, our experience has been that the more a group of managers studies and thinks about these attributes, the more they see room for improvement. In any case, this set of attributes does provide a framework which can aid the pursuit of excellence in Army labs.

The delightful cartoons were drawn by John Norris. We wish to thank all the Army lab managers who took the time to participate in our survey.

DR. RICHARD L. HARTMAN is director for research, U.S. Army Missile Laboratory, Redstone Arsenal, AL. He holds B.S., M.S. and Ph.D degrees in physics from Carnegie Institute of Technology and an M.S. degree in management from Massachusetts Institute of Technology.

DR. RICHARD G. RHOADES is associate director for technology, U.S. Army Missile Laboratory, Redstone Arsenal, AL. He has a bachelor's degree in chemical engineering and a Ph.D from Rensselaer Polytechnic Institute and an M.S. degree from Massachusetts Institute of Technology.

In-House Laboratory Independent Research



By Dr. James Gordon Prather

It appears that, at any given time, there is a study being conducted, or about to begin, or just ended, calling into question the need for Department of Defense (DOD) in-house laboratories. If that study assumes or concludes (as all thus far have done) that the need exists for in-house laboratories, then the bulk of the study effort is devoted to what has been done, needs to be done, or could be done to improve the health of those laboratories.

In late 1961, Secretary of Defense McNamara had become concerned about the health of DOD in-house laboratories and directed the military departments to come up with a program for strengthening them. As one element of that program, he directed that "Depending upon the mission and nature of the work of the particular laboratory, a fraction of the annual laboratory budget shall be set aside for work judged by the laboratory director to be of promise or importance without need of prior approval or review at higher levels. The results of this work shall be reviewed by the Assistant Secretaries for Research and Development of the Military Departments."

That was the beginning of the DOD In-House Laboratory Independent Research (ILIR) Program.

Secretary McNamara had become concerned about in-house labs as a result of his being one of seven principal participants in a presidential review of government contracting for research and development. The review had begun in July of 1961 and was chaired by the then Budget Director David Bell.

In their report to the president in the spring of 1962, the group stressed the need for strong internal R&D competence in the government. First class in-house R&D facilities were to be maintained, assignments made to government R&D facilities were to be significant and challenging, and first class scientists were to be recruited and retained. Finally, more authority was to be delegated to individual laboratory directors to make decisions relating to programs, personnel, funds, and other resources. In particular, such delegation was to include "...providing the research laboratory director a discretionary allotment of funds, to be available for projects of his choosing, and for the results of which he is to be responsible."

The military departments were never furnished further guidance by the secretary on how these ILIR programs were to be carried out. The Army chose to follow the tenor of the Bell report.

Laboratory directors inside and outside the government know that one way to attract and retain first class scientists is to allow them to work on whatever interests them. The problem is that whatever it is that interests the scientists is not often what the lab director wants done. So the lab director makes a deal; if the scientist will work on a big problem the lab director wants solved, then the lab director will find something the scientist really wants to work on. That way everyone is relatively happy. The lab director gets his work accomplished by first class scientists and the scientists get to do some of the things they really find interesting.

The Army ILIR Program is carried as a separate program element in the budget (PE 61101A) and amounts in FY 85 to $24.4 million, or about 10 percent of the total Army research (6.1) budget. Allocation is made by the assistant secretary of the Army for research, development and acquisition (ASA(RDA)) directly through the director of Army research and technology to the technical directors at each participating Army laboratory or qualified research activity. Allocations are made each year on the basis of an independent evaluation of the results of the previous year's effort.

Those laboratory directors who do especially well in the evaluations can expect to get a greater allocation and those who do relatively poorly can expect to get a lesser allocation. The real growth in the total ILIR program element has not kept pace with the rest of the Army budget. (Nor, in fact, has such a growth in ILIR been proposed or justified. Although ILIR projects should be mission related, the program, itself, does not exist to fulfill an Army mission. It could even be argued that real increases in the total ILIR program element related to anything other than a measurable increase in the health of Army labs would defeat the purpose of the program.)

No echelon between the ASA(RDA) and the laboratory director (including the director of Army research and technology) has the authority to reprogram funds from the account, issue guidance or direct the program, or "monitor" the program.

Guidance issued by ASA(RDA) to Army laboratory directors is as follows:

- Any Army RDTE activity having professional staff and laboratory facilities can participate.
- Any qualified activity can elect not to participate in any given year without prejudice.
- All funds allocated are to be spent within the current fiscal year.
- All work supported is to be of Army interest and mission related.
- No funds should be spent on contract, except in support of a principal

investigator employed by the laboratory or in a cooperative research effort with universities or other government laboratories.

- No funds are to be spent in violation of other Army or DOD directives (e.g., those regulating the purchase of computers, etc.)
- No funds should be spent on programs which had been proposed for inclusion in the lab's regular Defense Research Sciences (6.1) Program at the earliest opportunity.

At the end of the fiscal year each participating technical director must provide the ASA(RDA) a report including: how much ILIR money he allocated, how he spent the money on individual projects (with supporting Form 1498's), a description of each project and his reason for funding it, his evaluation of the results of each program and of its future, and his evaluation of the ILIR Program at his lab.

In the past several years, ASA(RDA) Dr. Jay R. Sculley has asked the Board on Army Science and Technology of the National Research Council to evaluate the ILIR reports. The members of this prestigious board are well acquainted with Army laboratories, the ILIR Program, and with industry independent research and development programs.

The members were provided with copies of the ILIR reports weeks in advance of their convening to compare notes and arrive at consensus evaluations. They have viewed favorably projects that contained bright new ideas, had a possibility of high payoff, were related to (but not integral part of) a lab mission, were transferred to a "core" research program when successful, were terminated when unsuccessful, and improved the lab's capability or enhanced stature of lab scientists and engineers.

ILIR projects should involve the lab's best (or those who aspire to be the best) and they should not involve "professional ILIR employees" (that is, those who work on ILIR projects to the exclusion of laboratory "core" projects year after year after year). The idea is to make the lab better capable of carrying out its mission and its mission is not to do bigger and better ILIR projects. If a lab director really believes that having a group of researchers doing nothing year after year but working on ILIR projects makes his lab better able to carry out its assigned mission, then he need only present the evidence in his ILIR report.

It's possible that a lab might, in any given year, get too much ILIR funding to spend profitably. Occasionally, technical directors will realize this and turn some of their allotted ILIR funds back. That is better than funding projects that are not appropriate ILIR projects.

Of course, if a lab director does want to fund in the ILIR Program a project he proposed to do in his "core" program but was not able, he should go ahead. But, in his year-end justification he must give his arguments for doing so.

After all, ILIR funding is no different in that respect. Continued funding is predicated upon results. In the case of ILIR, the results are supposed to be an improved Army laboratory, measured in terms of capability to carry out assigned mission and in terms of quality, morale, and retention of scientists. It is that sort of result that the ASA(RDA) attempts to evaluate each year. The success of individual ILIR projects is relatively unimportant in comparison to an improved Army laboratory system.

The program is widely viewed as being a success. Congress seldom cuts the amount requested in the president's budget submission. In 1972, the General Accounting Office (GAO) audited the DOD ILIR Program. The purposes of the review were to determine whether the objectives of the program were still valid, whether the objectives of the program had been made clear to all participants, and whether the program as implemented was meeting the original objectives.

GAO found the program generally to be a success, as evidenced by the fact that the majority of ILIR-supported projects were considered to be "research accomplishments of a high order of excellence." They found that many ILIR projects undoubtedly contributed in some way to strengthening in-house laboratories.

GAO found that some participants considered "strengthening in-house laboratories" to be an unmeasurable goal. However, most participants supported the program and believed that criteria were sufficiently general that the laboratory technical directors had the latitude to do almost anything they really wanted to do. Most lab directors also did not consider the administrative requirements to be burdensome, and welcomed the opportunity to present and justify their ILIR projects at the assistant secretary level.

The GAO and the Army Audit Agency did find some instances wherein ILIR funds were being used to augment or replace "core" programs. The Board on Army Science and Technology has not discovered any such instances in the past several years and it is to be hoped that guidance has been sufficiently clear that no such instances have occurred.

Although the number of successful ILIR projects is quite long, some of the more recent successes are:

- An innovative concept to provide a tank or a helicopter gunner with an image-stabilized muzzle view of his target.
- A method of reducing residual compressive strength at notches in large caliber weapons.
- The adaptation of a low cost speech recognition unit to passively identify acoustics target signatures.
- The achievement of a 10-fold improvement in magnetic structure compactness for millimeter wave traveling wave tubes.
- Demonstration of the penetration performance of a rocket delivered very light, very high length-to-diameter-ratio kinetic energy penetrator.

The ILIR Program is now close to a quarter of a century old. Virtually every study of DOD laboratories has stressed the need for such a program. The lab directors like it. They believe it helps them attract and retain good scientists and engineers. They believe that it gives them a certain latitude and opportunity for entrepreneurship which they find necessary for running a good laboratory. Congress seems to agree on the necessity of such a program. Even upper management of the laboratory system, prevented from exercising any control over ILIR spending, seems to agree on the necessity of such a program. With that kind of support we could probably expect the program to continue for another quarter of a century.

DR. JAMES G. PRATHER is deputy for science and technology in the Office of the Assistant Secretary of the Army (Research, Development and Acquisition). He holds a B.S. degree in physics from the University of Oklahoma and a Ph.D in nuclear physics from Utah State University.

Walter Reed Army Institute of Research

By COL Franklin H. Top Jr.

The Walter Reed Army Institute of Research (WRAIR), has fared very well in recent Army laboratory competitions. In 1979, 1980, 1981 and 1983, the WRAIR received Army Laboratory Awards for Excellence. In 1984, these awards were surpassed by the institute's selection as Army Laboratory of the Year.

The WRAIR is honored by these awards, not only because the Army has recognized the strength of our scientific productivity, but also because the selection has reaffirmed that WRAIR's basic mission to protect military personnel from military hazards — infectious diseases, combat shock, microwave and blast wave effects, and chemical warfare — is a critical part of military readiness and sustainability. These awards are an indication that our approach to research in a military setting is right.

What is that approach? It involves, today, a change of emphasis from the internationally recognized infectious disease research center that we have been to a laboratory more closely connected with the realities of military problems, present and future.

In the past five years, the institute has made major changes in emphasis. From no activity in chemical defense research in 1979, our drug development group now spends over 50 percent of its time constructing antidotes and prophylactic drugs to meet the chemical threat. We have increased markedly our programs in defining medical effects of Army system hazards — microwaves and blast overpressure. We have made major new starts with evaluations of the new manning system, the light infantry divisions and the military family.

While these new missions have encroached to some extent on our traditional orientation, the WRAIR has been able to maintain vigorous, productive programs in infectious disease drug and vaccine development which have exploited successfully the new recombinant DNA and monoclonal antibody technologies.

A second major change in approach emphasizes development. WRAIR has always had strong tech base programs, but has lacked sufficient development funds and manpower to move many of its ideas to the field. MG Garrison Rapmund, commanding general, U.S. Army Medical Research and Development Command (USAMRDC), has been successful in obtaining developmental funds. To assist in the management of these funds he has created two new activities within the command: the U.S. Army Medical Materiel Development Activity and the U.S. Army Medical Research Acquisition Activity. We are working with those groups to expedite development and fielding of antimalarial drugs, the nerve agent prophylactic drug pyridostigmine, and several vaccines against serious military disease threats.

WRAIR has been fortunate in attracting and maintaining outstanding professionals. The institute expects its people to "be all that they can be." We expect them to become leaders in their disciplines, to chair sessions at major scientific meetings, to consult for the National Institutes of Health, the Center for Disease Control and the World Health Organization, to know where their field is, where it is going and what new concepts and technologies will be useful in solving Army problems.

The institute depends heavily on peer interaction and peer review to assure its scientists' growth and productivity. A colleague encountered at a national meeting is the best person to encourage a good idea or deflect a bad one before it wastes time and money. Even during severe restrictions on travel funds in past years, WRAIR cut administrative travel severely to get as many investigators as possible to scientific meetings in order to keep our people current. We knew it would ultimately pay off in the form of more vigorous programs.

Our goal of excellence extends to all employees, not only scientific investigators. Many of our civilian and enlisted technicians accept major research responsibility and conduct and present research at national meetings. We are particularly proud of our enlisted personnel. Last year WRAIR personnel won both USAMRDC and Health Services Command Soldier of the Year. Many of our officers and enlisted personnel work hard on their own time to gain the Expert Field Medical Badge. For the past several years, at least one of our enlisted personnel has received a direct commission.

The institute has encouraged its professionals to work together; one of its major strengths has been putting together teams from diverse disciplines to attack major problems. Indeed, small ad hoc working groups often form spontaneously across departmental lines to pursue new technologies as they emerge; it is a measure of our scientific strength that these groups may exist for six to 12 months before the director becomes aware of them.

Another important contribution to vigour is new blood. The National Research Council Fellowship Program and Intergovernmental Personnel Act programs allow us to bring young investigators and new ideas into our programs and keep us fresh.

The institute also maintains scientific vigour and innovation through collaboration. A long standing program of extramural contracts with universities and industry has been a rich source of outside stimulation.

We have expanded our collaborations, both within and without USAMRDC, since the complexity of current scientific development makes it unlikely for any one laboratory to have all the capabilities to drive research at an acceptable pace. In current work exploring

concepts for malaria vaccines, for instance, we have collaborated extensively with scientists at the National Institute for Allergy and Infectious Diseases, the Naval Medical Research Institute and the Smith Kline and French Co., as well as with USAMRDC. All these groups have been excited by the pace and power that teamwork has provided. We believe that collaboration between laboratories will be of increasing importance in future military medical R&D.

WRAIR has always tried to think ahead of the military situation, tried to look at the military problems that might occur, bringing with them the medical problems we would be asked to solve.

Medical research is a long process. Even the most clear-cut solution, rapidly arrived at, can run into years of testing for safety and efficacy before being released for human use. That means we cannot wait for a military situation to generate a medical problem before we begin to tackle it.

WRAIR has developed a strong base for screening potential situations for their medical significance. We attempt to stay close to our customer. Our laboratories in USAREUR and at Fort Bragg enabled us to identify problems in unit cohesion and family stability as they emerged and permitted us to work with the line to implement solutions quickly. Our laboratories in Thailand, Malaysia, Kenya, and Brazil, like the ones at Heidelberg and Fort Bragg, allow us to recognize emerging problems quickly.

Another way in which we are in direct contact with the field is through EPICON, the Epidemiological Consultant Service WRAIR operates for the surgeon general. EPICON team members are on 24-hour alert to investigate outbreaks of disease or other health hazards in military populations.

Despite changing Army research and development requirements, WRAIR management has attempted to maintain a stable research climate in the tech base. For the past two decades, WRAIR has been directed by officers who are scientists; they have set high standards for scientific excellence. All have been visible and accessible. They have been capable of rapidly supporting good ideas and equally quick to discard flawed concepts. They have concentrated on military relevance, but have been humble enough to recognize that it is impossible to predict which potential military medical problems will be realized 10 years hence. In that uncertainty, they have been willing to provide stable support for a few good people in each potentially critical tech base area, even if this discipline is not immediately promising or of high priority. This stability has enabled the institute to maintain a strong nucleus of expertise which permits rapid and rational program expansion due to changes in Army priorities or an exploitable breakthrough.

Finally, the WRAIR has received outstanding support up the line. MG Rapmund and his staff at USAMRDC Headquarters have been most supportive and have rigorously defended the need for a strong tech base as we expand more into development and testing. They have guided us into new areas important to the Army and consistently fought to get us required resources.

The Army deputy chief of staff for RD&A has been keenly interested in our activities and also has been a strong supporter. The Office of the Assistant Secretary of the Army (RD&A) too, through its Independent Laboratory In-House Research Program, has allowed us to be aggressive in pursuing risky new starts, many of which have become important parts of our tech base and development programs.

The institute acutely needs to replace its aged and inadequate laboratory facilities and we are grateful for strong support from the Army R&D community and the surgeon general in attempting to solve this problem. Such support is critical to the institute and provides the necessary fuel and inspiration for the future.

WRAIR has been fortunate. The Army has given us an excellent opportunity to fully utilize our talents in science. We have had the opportunity and the joy of seeing our ideas lead to improved Army doctrine and training and to enhanced protection of the soldier through vaccines, drugs, and improved military standards. We all believe we must offer the best soldiers in the world the best protection against military hazards.

COL FRANKLIN H. TOP JR, MC, is director of the Walter Reed Army Institute of Research. He holds B.S. and M.D. degrees from Yale University. Prior to assuming his present position he served as director of the U.S. Army Medical Research Institute for Chemical Defense.

A Glance at WRAIR

The Walter Reed Army Institute of Research (WRAIR) is the oldest and largest of the laboratories in the U.S. Army Medical Research and Development Command (USAMRDC). Founded in 1893 as the Army Medical School, the first school of preventive medicine in the United States, WRAIR has always had, as an associated mission, the conduct of research in the field of military preventive medicine. Today the mission includes studies in combat casualty care as well.

Staffed by approximately 800 researchers and support personnel, the workforce is about equally divided between military and civilian. As would be expected in such an institution, advanced degrees are held by many of the people assigned to WRAIR, and embrace a wide variety of disciplines. In 1984, their research was reflected in over 290 articles published or in print, in more than 107 professional journals.

Much of the work of the WRAIR goes on in the main laboratory, located in Washington, D.C., but small elements of the WRAIR have operated in other locations both in CONUS and OCONUS since MAJ Walter Reed led the Yellow Fever Commission to Cuba in 1900. WRAIR researchers are presently in Fort Bragg, Thailand, Malaysia, Kenya, Brazil and West Germany. Overseas research provides current knowledge of medical threats to the Army.

Continuous Comprehensive Evaluation

By LTC Charles J. Borns

Army operational testing and evaluation sports a new acronym — C^2E, which stands for Continuous Comprehensive Evaluation. It's not just a catchy term but represents a major change in the way the Operational Test and Evaluation Agency (OTEA) conducts its business. C^2E is a shift from the agency's past orientation on testing to the conduct of independent system evaluations. It says what it means: focus on the evaluation of major system acquisitions; evaluate the system's progress in reaching its operational effectiveness objectives over its entire development cycle, not just at major decision points; and utilize all available information in the evaluation process. C^2E means get in early, stay late and keep the Army's decision makers up-to-date.

What brought about this dramatic change in OTEA's direction? The change in orientation from operational tester to the Army's continuous, comprehensive evaluator, and the genesis of the C^2E concept, resulted from three major, catalytic occurrences during calendar year 1983. In February 1983, the deputy under secretary of the Army for operations research conveyed to the OTEA commander that the Army Systems Acquisition Review Council (ASARC) principals were dissatisfied with the scope of evaluations provided at milestone decision reviews. The essence of their criticism was that operational testing and evaluation, as practiced, was "too late, too early and too narrow." At first glance their complaints appeared as a contradiction in terms until one understands the core issues being surfaced.

Historically, operational testing and evaluation did not play a significant role in the materiel acquisition process until full-scale development because of the frequent omission of early operational testing (OT I) in acquisition strategies. Therefore OT II, more often than not, constituted the first time a system was subjected to the rigors of an operational test environment and served as the primary data source for information regarding a system's operational utility. Testing of a few prototypes just before the production decision is "too late," because the materiel developer's response time to correct system deficiences found in operational testing is almost non-existent. Since hardware design, contractual and production parameters are normally frozen at this stage of development, changes cause severe dollar and schedule impacts.

OTEA tested "too early," in that hardware available for operational testing was rarely configured to the final production specifications. Finally, system evaluations were "too narrow," in that the evaluation report was limited to the results of a single major test, and frequently only addressed whether the system "passed or failed" in attaining its required operational capabilities.

The second major force in forging the C^2E concept was an expansion of the OTEA mission. During the summer of 1983, the Army vice chief of staff directed OTEA to track the correction of major systems deficiencies found in testing, reporting the progress made in their resolution. Shortly thereafter, the under secretary of the Army further expanded the agency charter by directing that OTEA evaluate the system throughout its acquisition cycle, from concept definition through fielding. Both expansions in mission supported the emerging awareness in the Army that a continuous evaluation process is inherently better than one oriented to major decision milestones.

A third stimulus was provided by the U.S. General Accounting Office's (GAO) publication in the fall of 1983 of their draft investigative report, "The Army Needs More Comprehensive Evaluations to Make Use of Its Weapon System Testing." Their findings correlated with the issues identified earlier by the ASARC. The GAO concluded that many Army organizations contributed to the preparation of evaluations but the results reaching acquisition officials decision points were often fragmented. Seldom did the evaluations adequately interpret the test findings in terms of potential operational consequences. Evaluations needed to be broadened and integrated to provide a more meaningful and coherent picture of a system's development progress and potential operational effectiveness. The GAO also recommended that one principal evaluation agency be designated, with access to all the information generated by other agencies, to interpret and integrate it into one comprehensive evaluation.

These three events not only provided the incentive but supported the initiation of an internal review, by OTEA, of its traditional modus operandi. The agency's self evaluation indicated that when OTEA was organized in 1972, it had in fact, organized and focused its resources and attention on testing, and by default the evaluation process became a residual product of a well planned and executed field test.

To execute this new role, OTEA needs to "get in early" in the development process while opportunities for change exist. At this time, acquisition strategies are still fluid and necessary system and hardware changes can be accommodated with reasonable cost or schedule impacts. OTEA will "stay later" through deployment, validating corrections of system shortcomings, training, manuals, test equipment and user acceptability. This increased involvement will contribute to more meaningful evaluations that capitalize on and integrate data from all available sources, and satisfy the needs of OTEA's principal customer, the decision maker.

Finally, the "final exam, pass-fail" reporting approach has been replaced by a series of evaluative updates providing decision makers and the acquisition community with "real time" assessments of a program's status. These interim reports, as well as evaluations rendered at major decision points, will include risk assessments that address "so what" questions with analysis, projections and conclusions of how program variables will impact a system's operational utility. As the GAO stated, "comprehensive risk assessments should consider the acquisition cost, schedule and technical uncertainties in development plus the cost of delay, the military urgency, and the consequences of adopting alternative courses of action. An analysis of the consequences should include the added operating and support costs and decreased military utility which could result from fielding the system with deficiencies."

The agency's self evaluation defined the core elements of a continuous evaluation process for operational testing and evaluation. As indicated in Figure 1, OTEA's evaluation activities will begin at concept definition, be broader in scope and include interaction with all the players in the development of a system.

Continuous evaluation employs a broad analytic approach to the evaluation of developmental systems extending from earliest

concept formulation through initial fielding. The OTEA evaluator will give an assessment of the system's status in development at any time and report significant status changes based on best evidence to date, as opposed to the former "final exam" approach. This process will eliminate the current fragmentation of efforts which frequently occurs in the evaluation and analysis community, by consolidating all available data sources and inputs. The evaluator will integrate requirement analyses, studies, tactical and logistical modeling, surrogate and mock-up testing, development testing, operational testing, force development testing and experimentation and post-fielding surveys into a continuing, comprehensive evaluation.

As C²E is implemented, the acquisition community will note several constructive changes in the operational evaluator's role and activities in each phase of the life cycle management model.

During concept exploration, emphasis will be placed on early "harmonization and consolidation" of system technical and operational issues which contribute to the preparation of a broader set of decision maker issues. This set will define, at program initiation, the decision maker's major concerns that must be addressed during system development.

Upon approval of the decision maker issues, the operational evaluator initiates planning for C²E, identifying critical data sources and activities necessary in accomplishing an "issue based" rather than "calendar based" evaluation. The blueprint for the effort is the Test, Evaluation, Analysis and Modeling (TEAM) Plan, prepared and approved by OTEA. The TEAM Plan identifies the data sources to be utilized in the evaluation process, outlines the evaluation strategy, provides the schedule of C²E events, and contains the coordinated support agreements between OTEA and other commands, agencies or C²E participants. It serves as the independent evaluator's "road map" in executing his comprehensive evaluation.

Complete and detailed front end analysis during concept exploration is an effective means of reducing risk and development time. Therefore, increased use of surrogate testing is seen as an important element in the early evaluation of systems concepts. Such evaluations are useful in refining hardware requirements and solidifying operational doctrine before entry into the subsequent phases of development.

Once systems transition into demonstration and validation, OTEA's involvement will intensify, guided by the TEAM Plan. In the past, the agency's earliest formal involvement did not occur until just prior to the milestone I decision, if an OT 1 was conducted. Under the C²E concept, OTEA will initiate a "continuum of evaluations" that will monitor progression of systems through deployment. The independent evaluators will engage in a continuous discourse with the materiel developer, user representatives and decision maker. Those interactions will be characterized by frequent exchanges of information and status updates based on the best data available. The reports, while continuing to utilize operational testing results, will be augmented by the added dimensions of modeling, and other test and evaluation efforts.

The user software review is a new initiative that is not intended to duplicate the materiel developer's software validation and verification process. User reviews are envisioned as an analysis of how well the embedded software actually accomplishes its intended operational functions. Mock-up testing and operator trials are expected to gain prominence during this phase as a technique in the early identification of man-machine interface problems.

The active participation of OTEA with the development community during the first two stages of development will enhance information sharing, provide early identification of problem areas and facilitate timely corrective actions. Given this environment, full-scale development should progress smoothly, providing opportunities for refinements in concepts, hardware configuration, training and logistical support. OTEA will continue its close involvement with the systems development, providing interim evaluations and updates in preparation for the Milestone III Systems Acquisition Review Council.

Congress, by Public Law 98-94, requires that major defense acquisition programs will undergo "adequate operational testing and evaluation" prior to full-scale production decisions. It is anticipated that most major programs will undergo a low-rate initial production phase requiring a major follow-on test and evaluation to confirm operational suitability of production hardware. C²E will be an important process in the timely submission of the Army's evaluation to the director of operational test and evaluation, who recommends to the Congress the system readiness for full production.

After deployment, OTEA, under C²E, will continue to track the assimilation of the systems in the force structure by participating in field data collection. This initiative is the user equivalent of AMC's Sample Data Collection Program. While AMC collects reliability and maintainability data, OTEA and TRADOC will concentrate on the operational utility of the system, i.e., measures such as probability of hit actually achieved in field trials by using units. This information, coupled with reliability and maintainability data, will enable OTEA to track correction of deficiencies, and provide useful data for doctrinal and training enhancements.

In March 1984, the Department of the Army formally designated OTEA as the lead organization in implementing the Army's Continuous Evaluation Pilot Program. The agency was tasked to maintain management overview of the pilot program, coordinate its execution, and provide pertinent information regarding program status to HQDA. Five systems were originally nominated and approved for continuous evaluation under this program, but as can be seen from Figure 2, the number has increased to 20 with another 17 systems under a limited form of continuous evaluation.

The agency reorganized in April 1984 to align personnel resources with the expanded evaluation mission. The principal benefit of this realignment was an increase in OTEA's evaluation staff from approximately 20 to 100 evaluators.

C²E is an evolutionary concept. The process is still in its infancy in regards to implementing policies, methodologies, and pro-

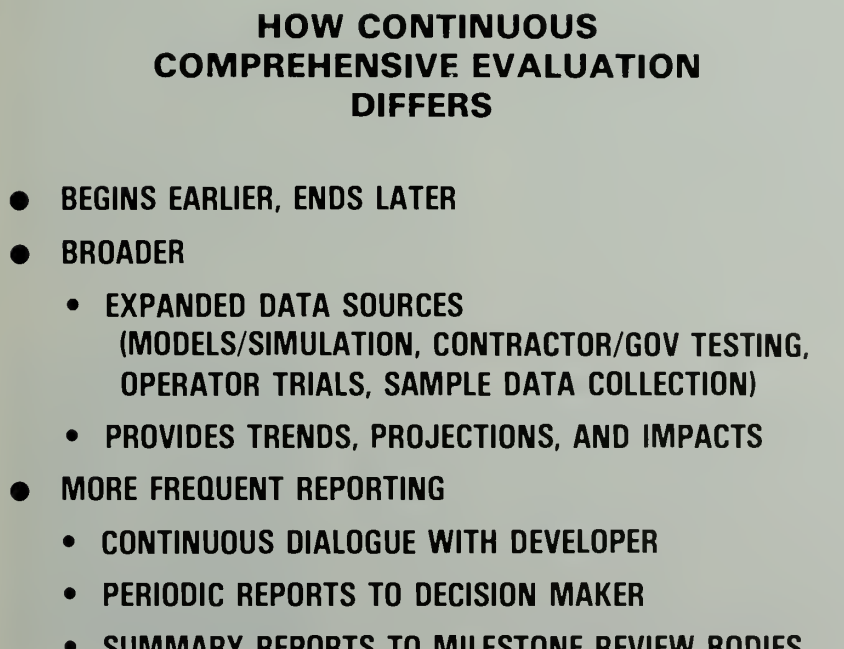


Figure 1.

SYSTEMS CURRENTLY IN C2E

FULL C2E

TEAM PLAN AND CONTINUOUS EVALUATION REPORTING

1 AAWS
2 ADEWS
3 AHIP
4 HIP
5 JSTARS
6 JTACMS
7 LHX
8 MLRS
9 MSE
10 PATRIOT P3I
11 PJH
12 RPV
13 SCOTT-MILSTAR
14 SGT YORK

SIGMA STAR

15 AFATDS
16 ASAS
17 DAS3
18 MCS
19 SHORAD C2
20 SINCGARS

LIMITED C2E

TEAM PLAN AND/OR CONTINUOUS REPORTING FOR SELECTED SYSTEMS

21 ACE
22 BFV
23 DGM
24 HMMWV
25 I-S/A AMPE
26 L119
27 LIGHTWEIGHT TACFIRE
28 M1A1
29 MTCC
30 NAVSTAR
31 PERSHING II
32 RECS
33 STINGER RMP
34 STINGRAY
35 TC3
36 WIS
37 XM40

IN ADDITION, OTEA IS MONITORING APPROXIMATELY 30 OTHER SYSTEMS, SOME OF WHICH WILL BECOME APPROPRIATE FOR C2E

Figure 2.

cedures. Significant effort is being directed at definitizing the "nuts and bolts" of this process. The major task before OTEA is the development of an execution strategy which addresses C^2E resource requirements, multiple-input data management procedures, compatible evaluation technologies and, of greatest importance, the formation of cooperative partnerships within the acquisition community to support C^2E efforts.

Our initial experience in the application of this concept has already produced tangible benefits. C^2E has definitely improved our daily working relationship with AMC and TRADOC by promoting a free flow of open, frank information. The perception that testers/evaluators are adversaries of the developers, frustrating the development process, is eroding. C^2E in new program starts is proving to be a major tool to identify opportunities to improve overall test management, supporting AMC's initiative to streamline the acquisition process. The Test, Evaluation, Analysis and Modeling Plan, a key component of C^2E, has prompted up front coordination and planning. This effort in the early stages of program development serves to synchronize critical events and insure the availability of required information, for major decisions. C^2E, as the integrating force in test and evaluation, minimizes costly duplication and optimizes productivity. OTEA has shown that early involvement by the operational evaluator, as with the Light Helicopter Family (LHX), Advanced Field Artillery Tactical Data System (AFATDS), Single Channel Ground and Airborne Radio Subsystem (SINCGARS), and Patriot Pre-planned Product Improvement, can serve as a catalyst in promoting accelerated system development.

The implementation of C^2E on systems well along in the materiel acquisition cycle has proven beneficial. OTEA conducted a user demonstration of the Army Helicopter Improvement Program (AHIP) hot mock-up in the contractor facility. These trials examined the capability of crew members to perform cockpit activities/tasks necessary to check, power up and operate aircraft and mission systems while wearing Mission Oriented Protective Posture (MOPP) IV ensembles and night vision goggles. Information gained on the difficulties crewmen experienced assisted in the planning and design for OT II, and raised issues within the community that required additional attention. This demonstration was a total community effort conducted with assistance from the Human Engineering Laboratory, the Aviation Center and School, the AHIP PM's Office, the Combat Developments Experimentation Command, the Chemical R&D Center and Bell Helicopter of Fort Worth, TX. This effort validated C^2E as the instrument for promoting productive community involvement, bringing necessary expertise together in assessing and resolving system problems prior to production commitment.

An important element of the C^2E process is the Data Analysis Group, pioneered during the Patriot follow-on Evaluation III. It has significantly improved the operational test process. The analysis group is a team of experts with a broad spectrum of technical disciplines assembled for the purpose of assisting in the detail design of the test, as well as data reduction and analysis of test results. The principal product of their efforts is a single, high fidelity data base that accurately reflects how a candidate system performed during testing.

The Data Analysis Group process, employed during recent Patriot, SGT York, and AHIP testing, was a significant factor in the timely, orderly analysis of the vast quantity of data generated daily during these tests. OTEA was not only able to provide daily status reports but was able to submit comprehensive evaluations to the ASARC for Patriot and DIVAD within weeks of test completion, a first for the agency. This forum also provides on-site, in-depth analysis of system anomalies experienced during testing, and has contributed to initiation of corrective actions by the responsible agencies within a day of its occurrence. The analysis group success has lead to OTEA's adoption of this technique for all complex, high technology operational tests.

The success of C^2E is dependent upon the cooperative efforts of the entire acquisition community. Operating as a team, the conduct of reliable and affordable test and evaluations which minimize costly surprises late in the development process and satisfying the acquisition decision makers' information needs, are achievable objectives when employing the C^2E process.

MG William G. Tuttle Jr., commander OTEA, has stated, "C^2E is not a panacea; it is an innovative departure from traditional test and evaluation methods which will contribute to successful fielding of operationally effective and suitable materiel."

LTC CHARLES J. BORNS is a policy officer for the U.S. Army Operational Test and Evaluation Agency. He is a 1967 University of Dayton graduate, holds an MBA, completed the Command and General Staff College and attended the Defense Systems Management College. LTC Borns has been actively involved in Army test and evaluation, both development and operational, since 1978.

Atlanta XI Conferees Address Major Issues

Lively, candid and spirited are appropriate terms to describe discussions during the U.S. Army Materiel Command's Atlanta XI Executive Seminar, March 12-13, in Atlanta, GA. The theme was "Redoubling the Effort—A New Look at the Future."

Attended by more than 200 senior Army and industry executives, the meeting featured formal addresses and special panel presentations which were designed to provoke full and candid dialogue among all conferees.

The basic purpose of the Atlanta conference series has been to develop a better understanding between the Army Materiel Command and its industrial contractors regarding the acquisition of quality weapon systems and components. The specific objective of Atlanta XI was to continue the dialogue on the programs, policies and procedures that impact upon business relations and develop more confidence in the eyes of the Congress and the public.

Co-chairmen of the seminar were Robert O. Black, principal assistant deputy for research, development and acquisition, HQ AMC, and Robert L. Kirk, president and chief executive officer, LTV Aerospace and Defense Co. Kirk called the meeting to order, commenting that the Atlanta conference is widely recognized as the premier event of its kind. He called for full participation by the attendees.

Former AMC Commander GEN Henry A. Miley Jr. (U.S. Army Ret), now president of the American Defense Preparedness Association (ADPA), welcomed the conferees and noted that the original objective of the Atlanta meetings when they were established in 1974 was to improve communications between AMC and industry. This objective, he said, has really not changed. The ADPA assists in administrative details for the Atlanta meetings.

AMC Commander GEN Richard H. Thompson opened the formal presentations with a keynote address highlighting the theme of "In Search of Excellence." He chose this as the theme for his presentation for three reasons. First, he wanted to assure that the AMC and industry team continues to provide the best support possible to our Army of excellence. Secondly, he thought it might be interesting to analyze the Army/industry partnership against criteria in the Peter's and Waterman book of the same title. Finally, he felt the theme was compatible with the overall conference theme.

GEN Thompson directed a portion of his address to some of the initiatives undertaken to enhance AMC/industry relationships and what AMC expects from its contractors. He noted that last year he held four "Contractor Day" meetings with the senior leaders of both large and small businesses. The purpose was to focus on mutual problems and foster improved relations.

Another initiative was the recent establishment of an AMC ombudsman position on his staff with authority to speak and act on his behalf. The mission of the ombudsman is to improve the command's operating efficiency and readiness and to strengthen communications channels with industry.

GEN Thompson stated that there must be stricter compliance with technical and quality requirements that comprise the governments minimum needs, and that AMC contracting officers must be less tolerant of delinquent deliveries, unjustified cost increases and defective material. He added that future AMC decisions, based on smart business practices, will not only benefit the Army, but also industry.

GEN Thompson concluded by emphasizing that we must never forget that our reason for being is to support the soldier.

User's Perspective

LTG Carl E. Vuono, deputy commander of the U.S. Army Training and Doctrine Command (TRADOC), followed General Thompson with a briefing on "The User's Perspective." LTG Vuono began by stating that TRADOC is the Army's agent for developing user requirements. He noted that TRADOC determines needs by conducting an in-depth analysis of the entire battlefield, by analyzing the worldwide threat, and by studying available technology. The capstone of all of this, he said, is the Mission Area Analysis.

Vuono appealed to industry to offer their insights and tell the Army what things are not clear, particularly when applied to mission areas. When industry sees the total picture they are better able to see what problems exist, he said.

Specific areas where industry can help the Army, according to Vuono, are in helping guide technology in basic and applied research, in identifying technology which may be ready for production, and in identifying technologies which offer the greatest payoff. Vuono also discussed various acquisition approaches, such as product improvement programs, nondevelopment items, and full development. Regardless of which approach is taken, he added, we want industry to offer its best ideas and its best price. He stressed that the Army is committed to fielding a complete package.

Some of the considerations in total system fielding, said LTG Vuono, are the man-machine interface, incorporation of training devices early in the process, and consideration of logistics in the development process. In summary, LTG Vuono stated that the user, AMC, and industry must work together to field a total system and must be committed to doing business cheaper, faster, and with a better result.

The next speaker at the podium, Robert Black, provided an update and progress report on last year's Atlanta X meeting. He prefaced his remarks by stating that the Atlanta meetings provide a unique opportunity for industry and Army executives to put issues on the table, hash them out, and come to a meeting of the minds on how to best proceed. He emphasized that good ideas conceived during the Atlanta seminars should not be trapped in a report but should be executed.

Black then discussed some of the actions taken or planned in response to recommendations from last year's four Atlanta panels. One of the recommendations of the panel on "Institutional Constraints to Business" was that the Army improve its communications with Congress. In response to this, Black said during the past year a great deal has been accomplished, such as GEN Thompson's visits to key members and staffers of the House and Senate, and visits by other Generals with members and staffers to "drive home key points on a variety of programs." Additional actions in response to other recommendations by this panel included creation of review boards to take an executive look at requirements and better identification of the kinds of data really needed for successful program management.

In response to recommendations of last year's panel on "Pre-Award Institutional Responsibilities," actions have been taken to provide more open and informative communications between the Army and industry and actions have been taken to better support nondevelopment item (NDI) approaches.

In order to improve communications with industry, Black noted that advanced planning briefings have been emphasized, and "Contractor Day" conferences were initiated. One of the actions related to NDI, he said, was that the methodology for conducting market investigations has been refined in the 1984 "NDI Handbook."

Among the actions taken in response to the panel on "Post-Award Institutional Responsibilities", Black outlined the following:

- Changes to "Army Regulation 70-1" have been submitted so that initial operational capabilities won't be set until the acquisition strategy is fully staffed.
- Collection of contractor performance information has been improved.
- Improvements are being made in dealing with engineering change proposals.
- AMC has standardized implementation of warranties to reduce the burden on soldiers in the field.

Black concluded with a discussion of actions in response to recommendations from last year's panel entitled "Old Techniques, New Ideas—Suggestions for Change." He began by describing some of the actions that have been taken to tailor the weapon system

MG Arthur Holmes discusses improvements in the deployment process.

acquisition process, including the four-year development cycle. Said he: "A great deal of thought has gone into how we can make this happen." He also noted that in June of last year, AMC published a guide for management and application of preplanned product improvement.

During the past year, AMC also worked hard at making its R&D activities technological centers of excellence, Black said. He specifically mentioned institution of an initiative called the AMC laboratory improvement program.

Other efforts that he addressed included independent R&D programs, NDI, friendly foreign products and innovations and establishment of industry liaison offices as focal points for industry access to operational and organizational plans. Black closed his remarks by assuring the conferees that he would vigorously pursue the recommendations resulting from this year's Atlanta XI deliberations.

"The Legislative Pressures" was the subject of the first of four panels at this year's Atlanta seminar. Co-chairmen of this panel were William Paul, president, Sikorsky Aircraft, United Technologies Corp., and MG David W. Stallings, AMC deputy chief of staff for procurement and production. Other panelists were Stanley Kimmitt, assistant to the president for government affairs, Hughes Helicopters; J. Kenneth Driessen, vice president, Shipboard Surface and Air Systems, IBM Corp.; Dennis R. Brown, group executive, ITT Defense Group; MG Carl McNair Jr., deputy chief of staff, combat developments, TRADOC; MG Orlando Gonzales, commanding general, U.S. Army Aviation Systems Command; and Burton Blair, command counsel, HQ AMC.

During the past year, several pieces of legislation were signed into law. Two of the most significant of these were the Defense Procurement Reform Act of 1984 and the Small Business Federal Procurement Competition Enhancement Act of 1984.

William Paul presented an industry perspective on some of this recent legislation. He stated that some of the key issues as seen by Congress are over specification, out of control overhead costs, high prices for small quantity ordering, and price impacts of sole source contracts. He noted that industry's challenge is to recapture the confidence of DOD, the legislative branch, and the general public. He added that "horror" stories must be minimized and industry must work with Congress to achieve mutual legislative acceptance.

An Army viewpoint on the legislative issue was provided by MG Stallings who remarked that there is a lot of oversight of what those in the defense community are doing. Specific topics he addressed included free and open and competition, testing and qualification of new sources, increased costs for technical data rights, evaluation of economic production quantities, warranties, and changes to regulatory systems. He stated that other areas that could be targeted for legislation are multiyear procurement, specifications and standards, activities of the inspector general, and product assurance.

Other topics of the legislation panel included a discussion of proprietary and technical data rights by Burton Blair, a briefing on warranties and guarantees by MG McNair, an address on the impact of new legislation on small and disadvantaged businesses by Dennis Brown, and the competitive strategy being used on the Army's LHX Engine Program by MG Gonzales. Gonzales emphasized that competition is the center and the focal point of the LHX Engine Program. Said Gonzales: "We are requiring competition for all components and parts of the LHX T800 Engine Program."

Questions submitted to the panel following their presentations covered the subjects of equipment quality, regulation of the defense industry, and how to provide incentives for soldiers to encourage better maintenance of their equipment.

Luncheon Address

Candid and straight-to-the-point remarks related to the acquisition process and the credibility of the defense community were provided by Under Secretary of the Army James R. Ambrose during a luncheon address. Ambrose began by stating that solutions to problems often take time and that improvements don't occur as a result of one administration's efforts. Institutionalizing changes and persistence, he said, are the things that yield results. He added that, despite criticisms, the Army and industry have done a good job in many areas.

In a more critical vein, Ambrose said that in trying to correct deficiencies, we too often treat symptoms. Also, he noted, the cost of systems are driven up because of delays caused by continually redefining the threat after a requirements document is written. This, he said, needs to be toned down. He added that "we must move away from idealistic, technology-driven requirements."

Ambrose emphasized throughout his address that everyone would be better off if the acquisition process was speeded up. He applauded GEN Thompson's efforts to have a four-year development process and noted the Army's intent to field entire units at one time. Ambrose closed by saying that credibility with Congress can be restored by moving faster on programs. He noted also that the Army can show the taxpayer that money is being wisely spent.

The second Atlanta XI panel session, entitled "Building on Success—Program Structure," was convened following the luncheon. The co-chairmen were Merle L. Engle, president, Electronic and Space Division, Emerson Electric Corp., and LTG Robert L. Moore, AMC deputy commanding general for research, development and acquisition. The remaining panel members were William J. Crawford III, vice president and general manager, Engineering Projects Division, General Electric, Co.; Robert R. Mockenhaupt, vice president, Honeywell, Inc.; MG John W. Foss, commanding general, U.S. Army Infantry Center and School; Theodore Pfeiffer, technical director, Army Communications and Electronics Command; and Darold Griffin, assistant deputy chief of staff for development, engineering and acquisition, HQ, AMC.

Engle, in presenting an industry viewpoint, said that some of the challenges for industry are to help the services develop realistic specifications, to submit responsible proposals, to report problems early, and to accept responsibility.

LTG Moore, who provided the Army viewpoint, discussed those elements which contribute to successful acquisition programs. He began with a definition of success. Said Moore: "Simply stated, I think a successful program is one that, within reasonable bounds, meets its cost, schedule, and performance goals and is accepted by the soldier in the field as a genuine improvement in helping him get his job done."

Moore specifically noted the following "rules of engagement" for successful programs:

- Define the program, get commitments and constantly "sell" the program. (Moore said the MLRS and Black Hawk programs are good examples where this rule was applied.)
- Firm up the acquisition strategy and plan for deviations which may occur.
- Early on, think through and lock in the logistic support package.

Robert Black provides a progress report on Atlanta X actions.

• Army/industry teamwork is a key to success.

The third Atlanta XI panel, titled "Building on Success—Materiel Readiness," addressed those factors which, according to this panel, have improved materiel readiness. Co-chairmen were Billie Smith, executive vice president and general manager, Vought Missiles and Advanced Programs, LTV Aerospace, and Defense Co.; and MG Arthur Holmes, Jr.,commanding general, U.S. Army Tank-Automotive Command. The panel was comprised of Richard Webster, director of logistics planning, Westinghouse Electric Corp.; Grant Dove, executive vice president, Texas Instruments, Inc.; LTG Donald Babers, director, Defense Logistics Agency; David Mills, assistant deputy chief of staff for supply, maintenance, and transportation, HQ, AMC; and Edwin Greiner, AMC assistant deputy for materiel readiness.

Billie Smith, the industry speaker, discussed the current posture of Army readiness and some of the factors that enhance system maturity at the point of system release. He emphasized that materiel readiness is the bottom-line of why we are all in business, it is our final report card, he said.

Some of the areas Smith discussed which contributed to recent successes were the improved architecture of development and operational tests, better follow-on evaluations, maximum involvement in DT/OT by ILS and specialty engineering personnel and NDI.

MG Holmes followed Smith with a discussion of the factors which the panel felt have improved the deployment process and the improvements that have been or can be made in the logistics support of fielded equipment. Some of the factors he described as improving deployment are total package/unit materiel fielding, and contractor participation with fielding teams.

The final day of the Atlanta XI seminar opened with a breakfast address by Assistant Secretary of the Army for RD&A Dr. Jay R. Sculley. He noted that during the past four years the Army and its contractors have achieved significant results under a national program which has changed social, economic and military thought. He cited a number of areas where the Army has instituted important management reforms.

Sculley added that despite reforms and improvements, there is still a great deal of criticism of defense, the Army and the defense industry. The Army, said Sculley, has been charged by its leaders to approach everything it does with a spirit of correctness. He also challenged industry to assure that decisions and actions on public contracts are "right and proper."

He concluded by calling on both industry and the Army to do a better job in the areas of planning, quality and productivity and indicated that his office would become more and more involved in these areas to assure that they are improved.

The last of this year's four Atlanta panels addressed a topic which was termed by conference co-chairman Robert Kirk as perhaps one of the most interesting—"Structuring the Contract." The industry viewpoint was presented by panel co-chairman Ralph E. Hawes Jr., vice president and general manager, Pomona Division, General Dynamics Corp. He noted that the contract is the basic instrument which describes what will be done between the government and industry. He emphasized the need to go "back to basics."

The basics necessary for successful programs are a mutual resolve to act in the best interest of the program; a return to realism in schedule, cost, and performance; using the contract to motivate not punish the contractor; and making contracts flexible so the PM knows what his tradeoffs are.

Panel co-chairman BG Michael Pepe, deputy commanding general of the Army Aviation Systems Command, followed Hawes with the Army viewpoint. He agreed with the need to return to basics and described some contract structure changes. He concluded that changes in the structure of contracts will ultimately result in a better readiness posture, improve credibility and provide a better capability to protect our national heritage. He stressed that the contract is the bridge to our strength and our future, but that the contract is only as good as the parties to it.

Other members of the contract panel were Winston Hickman, vice president and comptroller, Defense Electronics Operations, Rockwell International Corp.; H.L. Libby, chairman of the board and president, Libby Corp.; Charles R. Rudning, senior vice president of programs, Bell Helicopter, Textron; MG John S. Crosby, commanding general, Army Field Artillery Center/commandant, Field Artillery School; James Hall, deputy for acquisition, Office of the Assistant Secretary of the Army (RD&A), and Bruce King, assistant deputy chief of staff for procurement and production, HQ AMC.

One of the questions submitted to the contract panel, but which was answered by LTG Moore, was: What innovative type contracts are now being used by Army? LTG Moore responded that innovative approaches are being used with the LHX program (the LHX engine RFP is a good example) and with the recent procurement package for night vision goggles.

Summaries

The concluding session of Atlanta XI was devoted to summaries, observations and closing remarks by Robert Kirk, Dr. Sculley, LTG Vuono, and GEN Thompson.

Kirk, in his summation, stated that he believes there is a strong need to concentrate more on the entire acquisition cycle, from start to finish. In reflecting on the conference, he noted a recurring call by many speakers to improve the requirements process. Said Kirk: "I think the requirements process needs as much attention as the development process."

Relative to warranties, Kirk indicated that AMC's approach to them seems to be good. However, he added that we must not forget that warranties cost money. Another area he touched on in his summary was increased competition. Kirk stated that the current thrust toward increased competition is good, but that flexibility must be applied when addressing this. He closed by recommending that next year's Atlanta conferees should evaluate how various programs lived up to LTG Moore's "rules of engagement."

ASA (RDA) Sculley stressed in his summary that four years ago there was a great deal of criticism of the defense community regarding cost growth of programs. He noted that much of the criticism today is not about cost growth because some good progress has been made in this area. Other key comments made by Sculley in his summary were:

• Most of us are more comfortable in today's materiel acquisition environment.

• Fielding of complete systems is a step in the right direction.

• As a result of past efforts, we have improved the lot of the materiel developer in uniform.

• Good contracting is a must.

• There is a great deal we must do in-house to improve the requirements process.

LTG Vuono emphasized in his concluding remarks that a number of "good things" are currently in progress as a result of the AMC/TRADOC team efforts. He called for a continuation of dialogue between the Army and industry in order for the Army to gain a greater awareness of what industry is doing and what good ideas they may have. He also appealed to industry to provide any suggestions which may be of value to the Army in dealing with constrained resources. He termed the requirement to provide supplies and spare parts "very important." Vuono also reiterated the importance of man-machine interface, the need for trainable systems with proper simulations, minimizing of force structure impacts, and logistical support requirements. He closed by expressing appreciation for industry's level of commitment to the defense effort.

LTG Thompson, in his summary remarks, described this year's Atlanta panels as "excellent" and "first class." He also announced that during the past few weeks he prepared an AMC "State of the Union," which is now available.

Thompson emphasized that the Army needs to do a better job of informing industry about what the Army is doing. Integrated logistics support, he said, is a good example. Additionally, he stated that he is concerned about requirements stability, and the intentions of Congress.

He solicited any suggestions the conferees might have with regard to the format of the Atlanta conferences and indicated that he intends to review the recommendations from the preceding 10 Atlanta meetings in order to evaluate how well AMC did in implementing suggestions resulting from those gatherings.

Atlanta XI was adjourned with general agreement that the meeting had provided a very productive exchange of views.

Army Research and Technology

Mr. Chairman and members of the committee. I appreciate this opportunity to discuss briefly with you the Army's Research and Technology Program. Thanks to your support, FY84 and 85 have been enormously productive. I believe the Army is providing clear centralized management under the leadership of Assistant Secretary of the Army (RD&A) Dr. Jay R. Sculley and Army Deputy Chief of Staff for RD&A LTG Louis C. Wagner Jr., along with a well defined set of Army needs which have been transferred into a focused research and technology program.

There are 34 separately identified Army laboratories plus a number of additional field locations throughout the United States. We conduct four classes of research and development, including combat materiel such as guns, tanks and ammunition; military medical research for protection against wounds, chemical and biological agents; combat engineering technology; and behavioral and motivational research.

Most of our laboratories cover the full spectrum of activities, starting with theoretical analyses and bench research; then focusing on useful technology products for the Army; aggregating those into sets of technologies for emerging Army systems; and supporting both the Army's materiel acquisition and operating and support functions. We have no ivory towers.

Our scientists and engineers spend time in the field. We have placed key technologists at major operational commands. Our program is developed and prioritized with a keen awareness of Army operational goals and current materiel deficiencies.

I would like next to describe, in a little bit more detail, each of the categories of the Army's technology base.

Let me start with Army-university relations. Several years ago, the Army decided that we could gain more return on our research investment if we established focused programs in areas of Army interest, and attracted a matching investment and interest from the academic community. One example is our need for an analytical capability to design rotorcraft. You may not be aware that until this time, there have been practically no adequately trained rotorcraft engineers produced by this nation's academic community. That has cost us dearly in terms of protracted development cycles and costly design errors on nearly every one of the helicopters designed to date. Recognizing this problem, the Army has established three major centers of excellence to provide faculty, graduate curriculum and a substantial increase in the numbers of students trained to a level of expertise in this area.

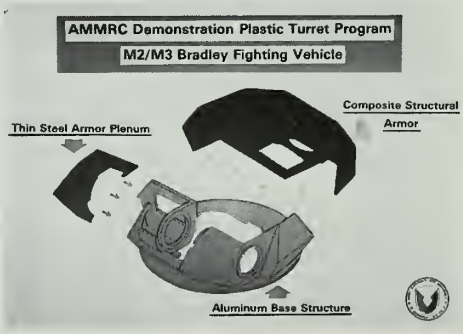
This year's budget request includes an expanded university research initiative. The Army proposes to apply the same management strategy and initiate cen-

The following testimony on th... Program was submitted earlier th... Committee by Director of Army k... Lewis II. It is carried here in a s...

Photo to the right shows pinpoint target impact of a fiber optic guided missile. The missile is barely visible just above the tank.

Army Research Directions

- Increased "University Research Initiatives"
  - Focused On "Centers Of Excellence"
    - Battlefield Sustainment (Logistics)
    - Soldier Performance Enhancement
- Keys On "Army 21" And Mission Area Deficiencies
- Increased Emphasis On:
  - Biological Warfare Defense
  - Landmine Detection & Countermeasures
  - Image Processing & Target Detection
  - AI For Training & Soldier Performance
- Decreased Emphasis On:
  - Chemical Agent Toxicity & Response (Transitioned To 6.2)
  - Weapons Materials Research (Transitioned to 6.2)



Army Advanced Development Provides The Cornerstones For Future Systems

- Fiber Optic Guided Missile Offers Low Cost Pin-Point Accuracy.
- Advanced Composite Aircraft Program Demonstrates Cost And Weight Breakthrough.
- Malaria Vaccine Will Significantly Increase Combat Readiness.
- Computer Adapted Screening Test Which Effectively Prescreens Army Applicants

. . An Investment in Excellence

rmy's Research and Technology
s ear to the House Armed Services
arch and Technology Richard B.
tly edited format.

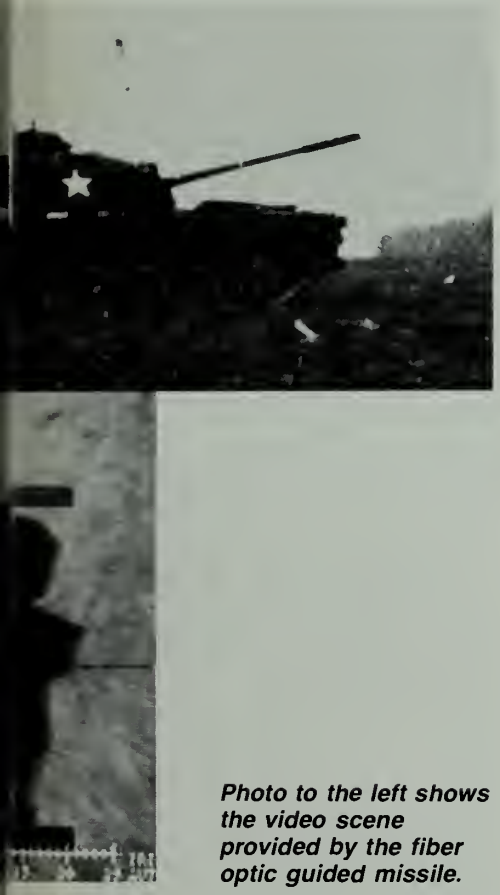


Photo to the left shows the video scene provided by the fiber optic guided missile.

ters of excellence for logistics research and development, applied mathematics, and soldier performance enhancement. We have also made some deliberate changes in our research program. At the same time, we have been able to transition several large work units into our exploratory development arena. Our research program is focused, has a sense of where it is going and enjoys a high degree of Army leadership interest and involvement.

Let me switch now to exploratory development. Time will permit describing only selected examples. For example, the way we make turrets on armored fighting vehicles like the Bradley involves the welding of many separate plates of aluminum armor. That is the best we could do with the technology available at the time we initiated production. Borrowing from our aircraft research, we saw an opportunity to substitute non-metallic materials which can reduce cost and weight, improve in-field repairability, and provide additional attractive characteristics. This block of fiberglass is the thickest composite armor produced to date and it appears that it will offer a 20 percent cost and weight reduction for applications like a future Bradley Fighting Vehicle.

One of the more costly components of radar systems is the traveling wave tube. These are large, complicated, expensive, and less reliable than we might like. We have been doing some important research in improving magnetic material which has allowed us to reduce, by a factor of 10, the size of traveling wave tubes while maintaining desired performance. I believe we will see these new devices used in large quantities within the next two years.

We remain concerned over the potential use of biological agents by our adversaries, and have been working hard to develop rapid, reliable methods to detect their presence. A dipstick we have developed positively identifies sub-toxic levels of T2 toxin. This product is the result of a major effort within the Army to exploit biotechnology to solve critical Army problems.

In summarizing the Army's exploratory development program, I would again emphasize that it is a directed program, focused on producing technology products to solve Army needs.

In the area of non-systems advanced development programs, one of our real success stories in FY84 was the demonstration of a fiber optic guided missile. Low-cost sensors on the missile send signals back to an operator who provides command and control back to the missile.

Finally, as you know, the Army inducts more than 200,000 soldiers every year and needs to screen them to match against military operational skills that the Army needs. The former paper and pencil test took four hours per inductee. Using computer-adapted testing, an automated test has been developed and takes only about 20 minutes.

Army/University Research

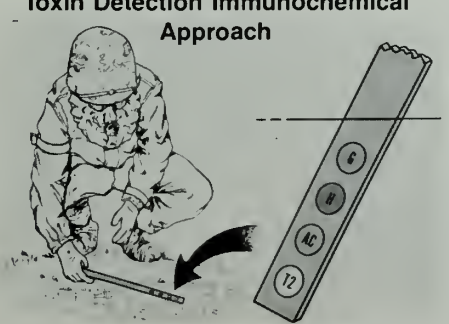
Focused On Centers Of Excellence To Solve Army Problems.

Example: As Lead Federal Agency in Rotorcraft Technology Army Established Centers At Georgia Tech, Univ of Maryland & Rensselaer Polytechnic Institute.

	Before	Current
University Faculty	9	25
Graduate Courses	12	25
Graduate Students	20	50

Payoff: Provides Key Intellectual Resources Needed For Successful Rotorcraft Development.

Toxin Detection Immunochemical Approach



Army Exploratory Development Directions

- Focused On Technology Products For Practical Demonstrations.
- Responsive To Army Mission Area Deficiencies.
- Increased Emphasis On:
  - Biomedical Defense
  - Munitions Lethality
  - Air-Land Battle Environment
  - Electromagnetic Pulse Compatibility
  - Soldier Performance Enhancement
- Decreased Emphasis On:
  - High Energy Lasers
  - Engineer Equipment (Electric Power)

Tandem Computers Inc. —

The following speech was initially delivered during the 14th Army Science Conference at the U.S. Military Academy, West Point, NY. Published here in an edited version, it deals with one company's perspective on employee participation in the management process. The author, James G. Treybig, is president of Tandem Computers Inc., Cupertino, CA.

A New Role for Employees and Managers

Values in America are changing as they relate to what has been classically regarded as the responsibility of a manager, and what has been considered the responsibility of each individual employee.

Managers will increasingly be called upon to focus their energies on the "people side" of organizations — and to facilitate strategy, communication, creativity, innovation, productivity, and quality. These tasks are time-consuming because they are complex and difficult, and require managers to have disposable time. If managers come to work on Monday and their whole week's schedule is already filled up with meetings, they have no disposable time to work on the more difficult and more important tasks.

The role of the individual, on the other hand, is to self-manage. Individuals want respect, they want a chance to be heard, and they want to develop, and to grow. Given the opportunity, individual employees can fill the gap left by managers moving out of classical roles into more creative functions, by picking up new responsibilities.

The role of the corporation is to provide opportunities for managers to take on new responsibility and for all employees to become involved in the management process.

When attempting to involve employees in the management process, executives must remember to focus their attention on goals rather than on the tactics utilized to accomplish these goals. This is not a Japanese concept, it is an American concept. It can be illustrated by considering what is commonly known as the "open door policy." The open door is merely a tactic.

The goal, and I think people often forget this, is to have managers who care about people. Perhaps the most important thing I will say today is that you must have managers who care about people—that is the goal. If your managers care about people, the door will always be open.

Employee Participation and the "Paperless Factory"

At Tandem, a philosophy of work has evolved which is crucial to our development of managers who care about people and employees who assume responsibility for the success or failure of the company.

An illustration of the participation of employees in the management process is our "paperless factory" in Austin, TX. Designed by one of our employees, the paperless factory allows the computer to become a tool to be used by the worker. It is not a tool to be used by the manager to monitor or measure the worker, but rather is a tool for the individual employee.

As assembly components are received by the factory they are recorded on the computer system. If a person assembles a group of components that becomes a part of a computer, that subassembly is also recorded with the individual's name on it; and he or she can, via a terminal, follow the subassembly as it goes on through the rest of the factory and leaves, in effect, with the assemblers name on it. The goal is for all individuals to assume the responsibility for quality, and as a result of this process, we have no separate quality assurance organization at Tandem. The standard for quality is set by the individuals in the different departments themselves, and is plotted and monitored by the computer.

This concept of "employee participation" in the management process may be applied to other situations as well. We recently applied these principles in our power supply factory in San Francisco where we wanted to improve a reliability factor called mean time between failure. Before this concept was applied, a power supply failed every 1,300 hours. Once we instituted a program of employee participation and a paperless factory, our reliability went up four times. This concept has also helped us to reduce unnecessary inventories. Employee participation reduced average work in process from 18 weeks to 2.6 weeks, resulting in a tremendous decrease in manufacturing overhead.

A company that has a creative management team which involves employees in solving problems and improving quality can make powerful inroads. We really didn't know how to do these sorts of things when we started up in 1974—we were just four people lying around on the floor trying to think of a name for the company. We worked a long time to develop a good business plan and somehow, by competence or luck, we grew to the $100 million mark exactly according to our plan. When we reached $100 million we began to analyze what we had done right so that we could plan to go from $100 million to a billion.

One of the factors of our success in the start-up phase turned out to be the fact that every employee knew where the company was trying to go. With that in mind, we began work on a five-year plan which would be shared with every employee and his or her spouse equivalent.

Most companies develop a five-year plan and then put it in a drawer somewhere. In our industry, some companies admit to stealing other company's five-year plans—so it turns out that the only people who know the five-year plan are management and the competition. It is far better, we believe, to share it with the employees.

It became immediately apparent that for employees to understand our five-year plan they must first be taught how to read and understand financial statements. For instance, one chart in the business plan showed that as a function of accounts receivables management, inventory levels, and pretax profit margins, Tandem would generate cash in the range of anywhere from $8 million to $74 million. It was important for all employees to understand that chart because it, to a large extent, determined stock price, and every employee of Tandem is a shareholder.

Of course, in order for employee participation to be effective, a company must have the right employees. For that reason, we consider it crucial that every employee of Tandem learn how to hire; because hiring is an art. I still interview a number of prospective employees every week. I do this not because I am making the hiring decisions myself, but because I believe that managers should have input from other employees that will help them to make the right hiring decisions. Our goal is for every employee at Tandem, manager and non-manager alike, to be skilled in the art of hiring.

Beyond sharing the business plan with our people, we strive to help every employee understand the measures of success—from innovation to asset management.

To accomplish the goal of maximum employee participation in the management process, we have developed a number of programs which provide the open environment necessary for creative interaction.

TOPs "An Infrastructure of Our Best"

One program that has become my favorite is called TOPs. TOPs stands for Tandem's Outstanding People, and it is a program of people-to-people communication. Every year, seven percent of the people at Tandem qualify for a TOPs event, and they and their spouses or spouse equivalents go on a company-sponsored trip together. As an example, a TOPs group of 78 employees recently went to the Mardi Gras in New Orleans.

A Culture of Self Management

By James G. Treybig

The unique thing about this program is that each TOPs event represents a true numerical cross section of Tandem, independent of salary or position. If 10 percent of the people at Tandem are secretaries, then 10 percent of the people at TOPs are secretaries. It represents Tandem. Sitting at the same table may be a brilliant PH.D. computer scientist, a vice president, and an assembler, all with one thing in common—each is outstanding in his or her occupation. In effect, the TOPs program creates within the Tandem organization an infrastructure of our best people.

Friday Popcorn

Communication is of paramount importance in encouraging employee participation, so to facilitate unstructured communication and exchange at Tandem we have developed what is probably our most famous program, which we call "Friday Popcorn."

Every Friday, at Tandem facilities in 90 locations across the nation and in 30 foreign countries, we have an informal meeting and serve popcorn, beer, wine, and diet soda, and everyone at Tandem is invited. A supplier or a customer can bring his or her boss and find me, or a banker, or a major shareholder, or the head of engineering, or a person working in any area of the organization. It is a kind of "family function" which helps to create relationships; relationships translate into a productive and more involved group of people.

High Tech Communication

Advances in technology also have improved communication at Tandem, through a system of electronic mail. Ninety-eight percent of our employees have terminals or direct access to terminals all over the world. Electronic mail at Tandem is a concept that is quite different than you might think. You can't call 5,000 people on the telephone and say "Help!" But with electronic mail, if you are in Switzerland and you have a technical problem, you can send a mail message to the whole world and the next morning you will have 15 solutions waiting for you. Electronic mail is a process, not just of communication, but of integrating people. It is a socializing force as well. If we tried to take electronic mail away from employees at Tandem, we would have a revolution.

Most companies have a journal or magazine. At Tandem our journal is called *Center. Center* gives us the opportunity to express our philosophy and goals to every single employee. As an example, we recently included our five-year manufacturing strategy and new product strategies. *Center* gives our people something to read while they are at home—but again, shares with employees just what it is we are trying to do.

We also have our own television network, and have earth stations in 43 locations. If I want to give a presentation to all Tandem employees or interact with a group of employees, I can do so at any time. This is true for Tandem groups in the United States, Canada, and Mexico, and we send videotapes to other places in the world.

Before our annual meeting, we hold, via the television network, an annual meeting for employees, who are also shareholders. We also have used the television network for introductions of new managers, TOPs promotions, descriptions of new products to be announced, new software releases, banking seminars, and a number of other projects.

Sabbaticals and Stock Options

In addition to effective communication, there are other factors which are required to create an environment in which employees participate in the management process. One of the most important factors is employee motivation. Motivation, of course, goes beyond financial considerations to other rewards for participation, such as the pride of being part of something that is successful.

I would like to touch on several things which we do at Tandem to keep our people motivated. One is the sabbatical. A sabbatical for us means that every four years every employee gets a sabbatical of an extra six-to-nine weeks of vacation. Many companies claim they have sabbaticals, but generally speaking they are available only to the officers of the company.

Most of the systems in corporate life send signals that we are not all literally equal, and I think everyone realizes that, but sometimes we are "equal," and some company benefits should stress that equality. For example, if an employee in the shipping department comes in on a Sunday to ship a board somewhere, he is more "equal" than I am. The sabbatical is a way for us to say that everyone is important, and that the person who works hard in shipping for four years works as hard as I work, and deserves a sabbatical.

Each year we give an equal number of stock options to every person, to further express this concept of corporate equality. When we hire people or promote them, we also give options, but that is for a different reason. One time each year we give the same number of stock options to everyone, as a way of saying "sometimes we are all equal."

To motivate people to assume self-management responsibilities, you have to be able to communicate with them, but you also have to let them participate and sometimes let them participate equally.

The Importance of Creativity and Quality

We are also concerned at Tandem about the way our managers view creativity, because creativity is a difficult process which is not necessarily "at home" in modern-day corporations. The creative person who in one corporation is stamped a "deviant," might in another be considered a "hero." The whole difference is the attitude of management. Do managers encourage creativity? Do they accept failure?— because nine out of 10 ideas are going to fail. Management, in this new role, must provide the framework for creativity to develop.

Another concept that is equally important in the role of management is the emphasis on quality. People who believe that American industry is losing ground to the Japanese should understand that the fundamental reason is our inferior quality. In our experience, products manufactured in Japan and used by Tandem might have a failure rate of one in 10,000, while the same product coming from the United States might have a failure rate of 50 percent.

American managers must give quality a high priority and must find creative ways to improve quality. Some mistakenly believe that quality costs too much—when in fact, it costs less—because no alternative is more expensive for a company than dissolution. It is clear that without quality a company will not survive.

At Tandem, quality assurance has never been our goal, rather it has been achieved through the accomplishment of other goals; such as having all happy customers, having the best place to work, and producing attractive products. If a company accomplishes those goals and concentrates on quality in everything it does, it will have high growth.

Conclusion

As Tandem strives to be successful in an environment of tremendous change, and as we attempt to foster productivity and creativity, we must have employees who will take new responsibility as corporate citizens: they must self-manage, they must be motivated, they must be part of the corporation, and they must understand where the corporation is going. In turn, managers must assume a new role of fostering creativity, productivity, people communication, and education.

Also the corporation, as an entity, must use new technologies to assure these processes occur by way of networking, teleconferencing, "Friday Popcorn," or other such programs. These things—people, management, creativity, and productivity—are much more important than computers; and that is a big statement coming from me.

Use of Diesel Fuels in Military Equipment

By Maurice E. LePera

Problems associated with operating diesel-fueled equipment in areas where low ambient temperatures prevail have been documented over the past several decades. Although much research has been conducted by industry in developing new fuel additives, many operators of equipment have adjusted to this problem over the years by monitoring their selection of fuels, improving fuel housekeeping practices, and insuring adequate maintenance for cold weather operation.

Within the last several years, however, there has been a significant increase in the number of low-temperature, fuel-related equipment problems occurring within the military. This increase is in part due to the introduction of turbine engine powered ground equipment to the field and the procurement of fuels having higher wax content (i.e., refinement of heavier crudes without additional upgrading needed to produce adequate sources of kerosene and/or light distillates). The combination of these two events has created a renewed user concern for satisfactory operability of diesel-fueled equipment, particularly those being operated by the military in Europe.

Diesel fuel for Army and other DOD ground equipment is procured under Federal Specification VV-F-800C (Fuel Oil, Diesel) which specifies the following four grades DF-A, DF-1, DF-2 (CONUS), and DF-2 (OCONUS). Grades DF-A and DF-2 (OCONUS) are intended for use in the arctic and Europe, respectively. Grades DF-1 and DF-2 (CONUS) are intended for use within the 48 states and are essentially the same grades which industry provides to civilian users under the American Society of Testing Materials (ASTM) D975 Standard for Diesel Fuel; namely, Grades 1-D and 2-D.

Grades DF-1 or 1-D contain higher proportions of kerosene blending fractions and, therefore, have inherently better low temperature operability characteristics. Grades DF-2 (CONUS) or 2-D, which contain substantially lesser quantities of kerosene fractions, have a greater energy content and are generally preferred by civilian users because of their fuel economy differential.

With both the federal specification and ASTM standard, two grades (i.e., DF-1 and DF-2 or 1-D and 2-D are provided to users with "seasonally adjusted operability" limits. That is, the cloud and pour point values which control low temperature operability are not fixed as are other specification parameters (e.g., flash point, distillation, ash content, etc).

The cloud and pour point values are seasonally adjusted in accordance with the 10th percentile minimum values. These 10th percentile minimum values provide a means to predict anticipated prevailing ambient temperatures within a given geographical area. This methodology is utilized not only by the military, but also by industry, as this technology is utilized in several ASTM fuel standards.

Diesel fuel supplied against Grade DF-2 (OCONUS) under Federal Specification VV-F800C presents a different issue. This fuel is intended for use in the European theater of operations. Because of existing international standardization agreements (STANAGs) described under STANAGs 1135, 2754, and 2845, the specification requirements of DF-2 (OCONUS) must be in conformance with the requirements of NATO F-54, the standard diesel fuel used by the NATO armed forces and supplied through the Central European Pipeline System. This fuel has fixed cloud and pour point values, as it is used year-round and must meet storage requirements. The cloud point is specified at -13C max, whereas the pour point is specified at 18C max.

Because of this interchangeability requirement and existing standardization policies, any other diesel fuel (i.e., Grade DF-1) cannot be made available for use by U.S. forces in Europe. Further, NATO F-54 by far possesses the best low-temperature characteristics of all ground diesel fuels being distributed within the Central European region as it utilizes the cloud point to limit wax content.

All civilian diesel fuels being marketed within Europe, however, use the cold filter plugging point for defining low temperature operability. The cold filter plugging point gives a limit which is somewhere between the cloud and pour point values. Diesel fuels refined to a cold filter plugging point limit will generally contain an appreciably higher wax content than those fuels refined to a cloud point limit.

There has been considerable advertisement and marketing of additives within industry that are reported to improve the low temperature operability of diesel and distillate fuels. These additives, referred to as "flow improvers" and "pour point depressants" have become widely used in CONUS to improve the low temperature characteristics of heating/burner fuel oils. These additives are essentially organic polymeric compounds which, when added to distillate fuels, lower its pour point.

These polymeric compounds cocrystallize on the wax crystals during their initial stage of formation and prevent the growth of larger crystals which eventually form the structure leading to gelling of fuel. However, these additives do not alter the cloud point characteristic.

Although their addition to fuels results in a significant lowering of pour point

values in some instances, the additives do not change the cloud point; hence, low temperature operability cannot be guaranteed, as essentially all U.S. designed equipment is "limited" by the fuel's cloud point.

It should be noted that flow improvement additives, when applied to heating and burner fuel oils, are highly selective. That is, they do not perform the same in each blend of fuels. They, therefore, are not universally effective as a solution for the user. Because of their lack in changing the cloud point as well as their responsiveness to base fuels in lowering the pour point, these additives are not to be used in diesel fuels.

Because of the extremely cold winters experienced during the early 1980s, a need surfaced for a means to blend fuels in the field as one approach that would reduce the occurrence of fuel-related operability problems. *A Field Blending Guide* was subsequently developed by the Belvoir Research and Development Center and distributed in late 1982. This document provided instructions as to how to determine the "approximate cloud point," what acceptable fuel products could be used for blending, their blending ratios, and blending procedures. This document can be obtained from Defense Technical Information Center by requesting *Report No. AD-A144-710.*

An important note is that the *Field Blending Guide* cautions against blending diesel fuel with either gasoline or JP-4 products. This mixing of a relative volatile fuel with diesel and/or distillate fuel creates an extremely hazardous mixture that can be ignited either by some external ignition source or by generation of electrostatic charge phenomena.

These are two near-term solutions to resolve the low temperature fuel-related operability problems which continue to exist with diesel-fueled equipment. The first is one of providing adequate information to the field on understanding the factors which contribute to fuel-related low temperature operability problems. This information covers the three interrelated variables; namely, the fuel, the equipment system, and user practice.

Proper housekeeping (e.g., removal of water bottoms, use of filter/separators, etc.) will reduce the potential for problems that can and will occur with lowering ambient temperatures. Preventative maintenance procedures, if properly followed, will also reduce the occurrence of fuel-related operability problems.

The second near-term solution involves the on-going efforts directed towards confirming the acceptability of JP-8 aviation turbine fuel (MIL-T-83133) as an alternate fuel to diesel fuel (VV-F-800). Engine endurance tests have been conducted and additional tests are underway that support this recommendation. In consonance with this effort, a NATO Ministerial Agreement in 1976 committed NATO nations to move towards use of a common commercial kerosene-based fuel for land-based jet aircraft operated within Europe. Currently, NATO F-40 (a military wide cut type aviation turbine fuel) is used by all NATO countries except for France and the United Kingdom.

NATO F-40 is commonly referred to as JP-4. This fuel is identical to the industry standard ASTM Jet A-1 except for the mandatory requirements of icing and corrosion inhibitors and conductivity additive.

In April 1982, a Joint Chiefs of Staff memorandum concurred in the conclusions and recommendations of the study on jet fuel standardization within NATO, with one exception. The exception was the test date of 1985 for conversion. During the June 1982 meeting of NATO's Working Group on Equipment Operability, the nations agreed to set Jan. 1, 1987 as the date for starting the conversion. This start date will be confirmed at the forthcoming 1985 meeting of the NATO Pipeline Committee.

This reconfirmation of a January 1987 start date is due to the resolution of a presumed cost differential issue between F-40 versus F-34 fuel and the U.S. Army's commitment for initiating the modification of the three helicopter systems that require product improvement programs to meet the Army's cold starting requirements. The three systems include the AH-1, UH-1, and OH-58 series aircraft. Although the start date is scheduled for January 1987, the identification of JP-8/F-34 as an approved alternate fuel for diesel and ground turbine-powered equipment scheduled for mid-FY85 will provide an option for its use during the winter seasons.

For the far-term solution, two additional approaches are also underway. The first involves a cooperative effort between the Belvoir R&D Center and the U.S. Army Tank-Automotive Command to develop an engineering design guide/standard for fuel systems of vehicles and equipment. The intent is to provide specific guidance on the system requirements enabling satisfactory operability with use of high wax-containing fuels.

This guide/standard will prescribe specifics on fuel filters, water separators, fuel line and filter heaters, coolant and/or block heaters, fuel tank and fuel line materials, optional system configurations, and other design criteria that will allow use of "marginal quality" diesel fuels. A first draft of this guide is expected by the fourth quarter of FY85.

The second approach involves another action directed towards use of NATO F-34 as a fuel for diesel-powered equipment. At the third meeting of NATO's Ground Fuels Working Party held in Mougin, France in October 1984, all nations agreed that in the content of standardization on commercial diesel fuels, the preferred solution was to replace NATO F-54 diesel fuel with NATO F-34 aviation turbine fuel. Concurrent with this proposal, all nations are to conduct studies on the cost factor difference, technical factors that might create problems, and industry's capability to supply the F-34 product. This Ground Fuels Working Party is an activity under the NATO Pipeline Committee.

MAURICE E. LEPERA is chief, Fuels and Lubricants Division of the Materials, Fuels & Lubricants Laboratory, U.S. Army Belvoir Research and Development Center, Fort Belvoir, VA. In 1982, he was the recipient of the center's Leadership Award. He received a B.S. degree in chemistry from the University of Delaware. Prior to his employment with the Department of the Army, he worked at Gulf Research and Development Co.

Embedded Training and

In its report to the secretary of defense, the Defense Science Board of 1982 said "Military training is good but not good enough...additional unit training resources are needed." A year later, the Army Science Board stated the same view. Each board had conducted extensive independent reviews of training programs and emerging technology in weapon systems and in weapon system training. Both boards recommended embedded training (ET) as a means to deliver systems training.

The Army Research Institute for the Behavioral and Social Sciences (ARI) and the Army Materiel Command's project manager for training devices (PM TRADE), in collaboration with the Army Training and Doctrine Command, have launched an applied research program to identify effective approaches to the embedding of training technology in new equipment systems. This article starts with a working definition of ET and describes the benefits expected from it. The ET research program aims to develop embedded training application guidebooks so that the "when, where, and how" questions may be addressed throughout the systems acquisition process. The article concludes with a more detailed discussion of this program.

Embedded training is easily and popularly understood as the use of advanced technology to train people in the use of advanced equipment technology. ET is built into video games. An instructional "floppy" to help you learn how to use your new personal computer is another everyday example of embedded training. But ET is usually only a part of the total training system for any major equipment military item. It is not dedicated to finding or advocating advanced technology for its own sake. Embedded training guidelines may also point to non-technical solutions, such as conventional paper-and-pencil, classroom, and hands-on laboratory instruction to prepare for and to supplement training delivered by ET in the operational equipment.

The unique practical challenge of the embedded training research program is the possibility of training people to do things that have never been done before as fast, as far and with the precision of advanced weapon systems. Even as the Fiber Optic Guided Missile (FOG-M) and other weapon concepts present new opportunities and potential demands on soldier performance, the new technologies present opportunities and options to deliver training and to learn about training itself.

Working Definition

We define embedded training as a training subsystem (hardware/software) which is incorporated into (but not necessarily integral with) the overall weapon or tactical system software and equipment configuration as an alternate mode of operation. The alternate training mode may operate off-line or on-line in actual equipment.

The ET subsystem provides training and assessment capabilities through the soldier-system interface using software control of courseware and simulation exercises on the operational equipment with auxiliary equipment as necessary. The use of auxiliary equipment is not preferred but, if necessary, can consist of plug-ins, strap-ons, or linkages to remote sources.

Embedded training is generally designed to provide training in the unit environment to further develop or to maintain operator and maintainer skill levels. It is, under some circumstances, used in the institutional school environment.

The Training Setting

On the surface, ET holds potential for use in both instructional and unit training settings as the "universal trainer." The ARI-PM-TRADE project will address that issue in terms of the training and cost impacts on both training operations and operational readiness, for these are important considerations in system requirements definition and training-system design.

From the practical standpoint, we expect that embedded training will not often be justified as a primary delivery mechanism in the school house because of the high initial investment in systems hardware and the continuing high operational and support costs historically experienced with operational systems in TRADOC schools. However, this is an intuitive "conclusion" which may or may not be borne out by the overall project findings. What this does underline, however, is that ET must not be considered an entity unto itself, divorced from other potential mediation approaches in design of the training systems; it emphasizes that the trade-off determination and analysis process must be followed in determining system embedded training requirements to the same degree that other user requirements are subject to trade-offs.

Benefits

An obvious value of embedded training is that it trains the user on the system he or she is to use. It is realistic. It is also timely in two important ways. First, it is in place when the system is delivered. Training integral to the system is provided at the time of system fielding. This timeliness ameliorates the delays usually experienced in the receipt of training materials, including training devices, at institutional and unit sites upon system fielding. These delays in the receipt of training materials can be as much as two to three years. Second, it can be used any time to fill otherwise idle time without human instructors or supervisors present. How many of us have watched troops on training exercises biding their time uselessly while waiting for ammunition or the opposing force to show up? Embedded training can provide more efficient and frequent training than is otherwise available through field and garrison exercises on operational equipment without ET.

A major benefit is the conservation of scarce ammunition and opposing force resources. Computer generation of targets and simulation of missile firing, for example, offers enormous reductions in cost when compared to live opposing forces and live missiles. The requirements for another resource, trainer and other training support personnel, can also be reduced. The numbers of support personnel needed to generate the message traffic and responses required for a "live" C^3I exercise, for example, are considerable. An intelligent computer aided instruction/ simulation package can achieve similar training objectives without the majority of these support persons.

Finally, operator checkout and maintenance of advanced systems may be built into the systems and trained on the systems. Experience with current systems and projections regarding future systems suggest that maintenance costs may be reduced or controlled by operators trained in using built-in-test modules and coached by the systems in taking corrective actions. "Down time" for maintenance could approach "repair time" if embedded training includes both operation and maintenance.

History of Growing Opportunity

Embedded training really began in the 1950s with the Air Force Semi-Automatic

Systems Acquisition

By Dorothy L. Finley, Irving N. Alderman, Stanley F. Bolin and Donald S. Peckham

Ground Environment system. This system was a natural opportunity which practically demanded ET. The operators had to train to stay awake. Since then, some of the systems developed to incorporate ET include Tactical Fire Direction System (Army), F14 (Navy), F15 (Air Force), Aegis (Navy), and Patriot (Army).

Some of the new systems currently under development in the Army which may include embedded training are the Light Helicopter Family, Howitzer Improvement Program, Advanced Field Artillery Tactical Data System, Air Defense Artillery Control System, Future Armor Combat System, All Source Analysis System, the Tactical Management Information System, and FOG-M. These systems cover most branches in the Army and a wide range of skill types. The increasing use of computer technology in operational systems supports a growing opportunity for ET.

The realization of embedded training in these existing and developing systems has been a spotty, hit-or-miss process. It has depended on someone with sufficient interest being present at the right time and place who could exercise an impact. These "product champions" for ET have also had to take a chance in doing so because there were no guidelines for embedded training development. They had to "wing it" in a new area of system development.

If we are to realize the objectives laid out by the Defense Science and Army Science Boards, we must correct this "hit or miss" aspect of the systems acquisition process. We must turn it around so that embedded training is always considered a possible option — as training devices are now — and dealt with as a part of an overall systematic system development process.

As the number of systems based on sophisticated electronic components grows, this view becomes imperative quite apart from the benefits of ET. As the weapons change, training changes.

The ARI Program

The ARI program in embedded training is directed toward answering the questions of when, where, and how to consider ET application in the systems acquisition process. The when question asks how soon ET in the acquisition process can be dealt with effectively. If embedded training is to be fielded as a system capability, the necessary functions must be provided during the system design and development process. However, since training is meaningful only in the context of the user's tasks, the system's functions and the user-system interface, the system development must have sufficient maturity to minimize the risk of any redesign or development that would impact on ET.

Similarly, the ET development must have sufficient maturity to minimize any potential need for redesign and development of the system functions to achieve training capabilities. To insure embedded training impact on any particular new system, we must look to an early and rather continual concern with the human dimensions if there are people in the system loops. We hope through research to be able to specify how soon system engineers really need to worry about people and ET depending on the nature of the system.

The question of where involves the identification of systems technological characteristics and operator/maintainer task requirements indicating the system is a good candidate for the embedded training option. Further, the scope of the ET requirement may vary in terms of numbers and combinations of tasks. Probably no one would dispute the opinion that the hand grenade is not a good candidate for ET. Nor would anyone dispute the opinion that many command control systems are good candidates for embedded training. But how about tanks? Some have suggested that the current Abrams tank could incorporate some limited ET capability.

Certainly, if the FOG-M is introduced to vehicles such as the High Mobility Multipurpose Wheeled Vehicle, ET capability will be introduced in terms of the FOG-M component. Future tank systems with onboard displays and computer systems will certainly be candidates for ET. However, embedded training is not limited to systems having computers and displays. Some mechanical and hydraulic systems might be designed to train or alert their operators. In short, we don't yet fully appreciate the range or know the characteristics of all the systems where ET can be applied.

Our research bias in searching for systems on which to do ET research is basically to look for variation in the types of human performance in the system. We cannot know, empirically, if we can reduce the varying types of performance consideration, and elevate performance levels until we try, and that brings us to the how question.

The how question relates to the core issues of embedded training design. How do you determine the proper scope of the ET package from a task training requirements standpoint? Which tasks or combination of tasks need to be trained? Which training technologies (e.g., computer aided instruction, simulation, voice) should be used? How should the learner-machine interface be designed to minimize the need for training and to facilitate the training that must be done? Factors bearing on these issues include skill acquisition and decay rates for different types of tasks, skill levels of incoming soldiers and personnel turnover rates, technologies available in the host system, space and power constraints on equipment strap-ons to the host systems, and feasibility of switch-to-training alternate mode during actual host system operations versus dedicated continuous operations when the host system must always be on-line. In this last case of continuous operations, some form of parallel processing may provide coaching during actual operations.

The ARI program to provide answers to the when, where, and how questions is a multipathed approach to be accomplished over the next five years. It includes developing embedded training in exemplar systems, laboratory technological research, surveys to establish the state-of-the-art and extant opportunities, and development of analysis methodologies. The goal is to institutionalize the consideration of embedded training in the systems acquisition process.

DOROTHY L. FINLEY is a team leader in the Systems Research Laboratory, Army Research Institute.

IRVING N. ALDERMAN is a senior research psychologist in the Systems Research Laboratory, Army Research Institute.

STANLEY F. BOLIN is a senior research psychologist in the Training Research Laboratory, Army Research Institute.

DONALD S. PECKHAM is an education specialist and acquisition director in the Technology Management Branch of Project Manager, Training Devices.

Planning the Future of Tactical Power

By Gayle D. Peterson

Seventy-five representatives from the Army, Navy and Marine Corps attended a Tactical Power Systems Symposium late last year, sponsored by the Army's Belvoir Research and Development Center. The symposium was part of an Army effort to improve the utilization of its engine-driven generators. Its purpose was to present ideas to improve techniques for the selection and application of mobile power generation and distribution equipment throughout the Army and to exchange information on current and proposed methods for power systems planning.

Topics covered during the day-long session included power system planning and management, power systems engineering, characteristics of military standard generators, power distribution equipment, "wetstacking" and load banks, load measurement techniques, user's concerns and anticipated changes to operating procedures.

"The Army staff has given us a new mission," according to Donald D. Faehn, acting chief of the Belvoir R&D Center's Power Systems Assessment Office, "to insure that we use our generators effectively. DA has directed a 30 percent reduction in the number of generators in the Army's inventory. We've got to take a hard look, not only at where our generators are, but, more importantly, at how they are being used. We wanted to use this symposium as a forum for the future."

After introductory remarks by Belvoir R&D Center Commander COL Dennis B. Bulger, the first speaker, Richard C. Goodwin, a weapon system staff manager, presented the Army Materiel Command's (AMC) view of mobile electric power. "The way we have been handling our electrical power needs is like the contractor who builds a new factory for his client and forgets to coordinate with the local electric company," he told the group. "Mobile electric power requirements must be addressed during the concept formation phase and at each review point. The developers of mobile electric power systems must work with equipment developers from the outset. This requires participation by all parties—project managers, combat developers, systems developers and users."

COL Gerald M. Tippins, the Training and Doctrine Command's system manager for generators and environmental control equipment, addressed user needs. TRADOC's recent Power Sources Study was concerned with generator problems related to systems management. One recommendation coming out of the study was to establish a data base for better management. Tippins feels "today's management does not consider generators as systems, is conservative and builds in too much redundancy. We need to move out with a generator data base, as well as accelerate efforts to assess power systems in the field."

He was followed by COL Charles S. Green, the project manager for mobile electric power, who gave a presentation on the developer's role in generator requirements. He cited as one of the most important new features in this area, the formation of Belvoir's Power Systems Assessment Office, which will serve as his technical arm for the development of generator requirements.

Faehn elaborated on the new office's functions, "We will assess the demands of total power systems. We'll look at different types of units and examine current regulations and standards in order to improve the way we use our generators and identify areas for improvement."

William A. Yauss of the Belvoir R&D Center's Tactical Energy Systems Laboratory followed up with a talk on power system assessment. He explained how load profile analysis techniques could reduce both the cost and weight of a system by using this method to select the smallest, most efficient generator for the mission requirement. The Power Systems Assessment Office has been chartered by AMC through the PM for mobile electric power to assist system designers and program managers in using these techniques. Its personnel have test equipment available to measure equipment and electrical loads to verify theoretical load profile analysis.

Some examples of how this works were presented by James P. Lucas from the Power Systems Assessment Office. One study showed that a reverse osmosis water purification unit which normally required a 30 kilowatt (kw) generator could perform nearly all of its functions when powered by a 15kw set. Another came about as the result of a problem obtaining generators for the topographic support system. The original configuration called for a combination of 15, 30 and 100kw generators with a total output of 1080kw. A study by the office resulted in a new power configuration for the system which required only 660kw of power and used 15 and 60kw generators instead of the heavier, more expensive 100kw model. This effort produced a saving of more than $100,000 per operating hour.

One of the most controversial presentations was a discussion of underloading and "wetstacking" by Dr. Alan Surosky, a consultant from National Technical Systems, Inc. "Wetstacking", which often occurs in cold weather when generators are run at much less than full capacity, causes leaking of oil and fuel, carbon buildup in the exhaust system and crankcase oil dilution. Studies found that, although these phenomena were annoying and indicated that the engine was not being run efficiently, underloading a generator caused no serious damage to the set. In such a situation, though, designers or users might want to consider a smaller generator.

Two more speakers, James W. Gale from the Office of the Project Manager, Mobile Electric Power and Walter C. Pierce of the Center's Product Assurance and Test Directorate, explained the characteristics of military standard generators and some of the procedures for

Walter Pierce and SP5 Bill Carey of the U.S. Army Troop Support Command's Belvoir R&D Center study data from a microprocessor-based power measuring device which continuously records information without hampering the operation of a generator or system being powered. On-site and laboratory analyses are being conducted to compile data for a "Generator Selection and Application Guide."

testing ruggedness and measuring loads. Of particular interest were a video tape showing the severity of railroad impact tests and a demonstration of a system that provides a readout of load measurement data and generator performance.

Most manufactures are used to building generators that will be left in one place. Questions and conflict frequently arise over ruggedness requirements for military sets which must be moved over various types of terrain. Gale's presentation offered a historical perspective, as well as current information on the capabilities and ratings of the DOD family of standard generators. Pierce demonstrated load measurement techniques using a 15kw generator set to power a topographic support system van while recording steady state short-term data and long-term cumulative time-at-load data.

The last two speakers, David R. Goebel and Robert A. Williams of the Tactical Energy Systems Lab, covered upcoming developments in power distribution and conditioning equipment. Several new power distribution systems are ready to be type classified and will have a strong influence on near-term developments. The Center's power conditioner program involved the development of two small, lightweight, solid state, militarized units which can be combined into sets. They will be used for frequency changing, power line isolation, inversion from direct current to alternating current and conversion from alternating current to direct current.

A future concern is the growing requirement for uninterruptible power sources for mission-essential equipment that has to remain operational through unanticipated power outages or power fluctuations. These requirements must be identified early and communicated throughout the development chain.

Faehn wrapped up the symposium by telling the group, "We want you to challenge the requirement right from the concept phase. Our office will be establishing a data base for the power requirements of different items. We will be working with the project manager to bring about changes in the procedures for requisitioning generators. In the past, equipment managers have often specified more power and redundancy than they really need for the mission and they weren't aware of the overload capability of the generators. Now we will be looking at the requirements of total power systems. In addition to assisting developers with their requirements, we will show them how to specify their generators and help them identify needed product improvements."

Faehn felt the symposium was very useful and plans to make it an annual event. "Next year, we will include workshops and panel discussions. Our goal is to get communication going and keep it going," he said.

GAYLE D. PETERSON is a writer/editor in the Public Affairs Office of the Troop Support Command's Belvoir Research and Development Center.

From The Field. . .

Belvoir Gets New Test Equipment

New equipment installed by the U.S. Army Troop Support Command's Belvoir R&D Center at Fort Belvoir, VA, gives the center an unusual test capability. Engineers in the Belvoir R&D Center's Tactical Energy Systems Laboratory will now be able to drive rotating machinery of more than 1,500 horsepower at speeds ranging from 10,000 revolutions per minute (rpm) to more than 15,000 rpm.

The first use of the new equipment will be for the evaluation of an experimental electric generator being developed as part of the Belvoir R&D Center's pulsed electrical power source technology base. This technology base contributes to the Army's R&D efforts in the area of directed energy weapons.

The test equipment consists of a gas turbine engine, gear boxes and a 160 kilowatt-hour flywheel. The large flywheel makes the speed of the system change very slowly, while the gear boxes provide a choice of output speeds that are both faster and slower than the engine's speed. Possible speeds include 2,400, 4,500 and 18,000 rpm. Other speeds can be obtained by varying the speed of the engine.

The engine, flywheel and a speed reducing gear box were originally supplied by the Navy. The Navy had been investigating an experimental aircraft catapult system. A speed increasing gear box was purchased separately by the Belvoir R&D Center.

Auxiliary equipment needed to operate the test system includes oil sumps that hold about 1,000 gallons. The associated coolers require 160 gallons of water per minute. A diesel powered generator is used to provide power for the oil pumps in case of main power failure. The flywheel stores so much energy that the equipment continues to coast for more than half an hour after the engine is turned off.

CSTA Installs New Computerized Lathe

A new, computerized, numerically-controlled lathe, recently installed in the Combat Systems Test Activity's (CSTA) Technical Shops Branch, Aberdeen Proving Ground, is expected to save more than 7,500 man-hours annually.

According to John F. Reynolds, technical shops branch chief, the $86,000 system primarily will be used to manufacture M-11 crusher-type pressure gauges used by CSTA in proof testing large caliber weapons.

The gauges, which are not available commercially, are individually machined by hand, a process which takes about 90 minutes per gauge, Reynolds said. About 15,000 gauges are used annually at CSTA and at other U.S. and allied nations' testing facilities around the world. All are made by the Technical Shops Branch.

"We've tried having these gauges made under contract by commercial manufacturers," Reynolds said, "but we've found that the commercial products cannot be made to tolerances as fine as we require. That is why we make them ourselves. Using the new lathe, we expect to cut 30 minutes or more from the manufacturing time for each gauge."

George Theisen, the lathe operator, said, "The lathe doesn't give us a finished product, but it does provide a greatly enhanced rough product which can be more easily ground to the fine tolerances we require. Another advantage is that the computerized, numerically-controlled lathe does not require a human operator. Once the program is loaded into the computer, the lathe will make M-11 pressure gauges all day. About the only human involvement deals with inserting steel bars (from which the gauges are made) into the lathe feed system and an occasional check to ensure the system is working properly."

Theisen said, "The computer can be programmed quickly to turn out any product required. Once the computer program is established, a 'hard copy' can be produced in the form of a punched tape. These punched tapes can then be stored and reloaded into the computer when future requirements for the same product arise. We eventually hope to go to a floppy-disc storage system," he said.

George Theisen, operator of the new computerized numerically controlled lathe recently installed at the CSTA Technical Shops Branch, programs the lathe's computer to begin manufacturing M-11 crusher-type pressure gauges.

Theisen said there are 10 machining processes that the lathe can perform. These are center drilling, drilling, roughing of outer and inner figures, semifinishing of outer and inner figures, finishing of outer and inner figures, grooving, and threading.

"Twelve different cutting tools can be loaded onto the turret of the lathe at one time. By telling the computer the location of each cutting tool on the lathe turret, the computer can then index that tool for the job to be done. All of the geometry of the cutting tools is already loaded into the computer," Theisen said.

Once the part is machined, the lathe automatically cuts the part off the steel bar and it is automatically transferred to a holding container. The steel bar from which the parts are being machined is then automatically advanced for the lathe to begin making another part, Theisen said.

"We can use steel bars up to 12 feet long and 1.25 inches diameter," Theisen said. "Eventually, we want to get a feeder mechanism for the steel bars that will allow us to avoid the need to reload the bar feeder one bar at a time. An entire day's work's worth of bars could be loaded in the morning and the machine left to run all day long with minimum attention from the operator."

The lathe is even designed to drop the waste material from the machining into a conveyor system that dumps the waste into a collection barrel for future disposal, Theisen said.

"An additional benefit the machine offers is in checking blueprints," Theisen said. "On a recent job, the engineering drawing's figures were incorrect for the product desired — in this case a one-quarter scale projectile. By loading the figures into the computer and having the computer draw the part on its video screen, the mistake was obvious and correcting it was quite simple. If a human machine operator had been faced with the same error, he never would have been able to find the error and correct it."

Reynolds feels the lathe will pay for itself in the first year of operation in terms of speeded work flow, less time consumed, a better product for the customer, and less waste of raw materials. He said that additional tools for the lathe have been ordered which will further expand its capabilities.

Army Explores Computer Image Generation

Military pilots often learn their trade by "flying" aircraft simulators through computer-generated terrain scenes. Similar scenes may someday help the Army plan battles and test missiles.

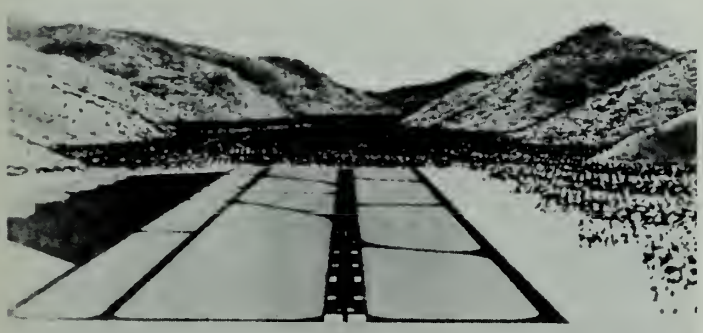
Two Army organizations—the Army Engineer Topographic Laboratories (ETL) and the Army Missile Command (MICOM)—have teamed with the Defense Advanced Research Projects Agency (DARPA) to apply computer image generation to tasks.

In December, a $7.6 million contract was awarded to the Boeing Aerospace Co., Seattle WA, for this joint Army/DARPA program. Over the next three years Boeing will develop four specialized computer image generation systems for the Army.

Computer image generation uses digital data bases and sophisticated processing techniques to produce realistic pictures of the terrain— pictures like the ones used in flight simulators. ETL scientists believe that such pictures can play a part in future command and control systems. MICOM plans to use computer-generated terrain scenes to simulate missile flights and test guidance algorithms. Under the Army/DARPA contract Boeing will build two image generation systems for battlefield management and two for missile simulation.

These Army systems will take advantage of image generation techniques developed under previous DARPA research programs. Scientists working on those programs designed and tested an advanced computer image generation system which produces highly detailed terrain scenes at high speeds.

This system combines digital terrain elevation and feature data with information from maps, photographs and satellite imagery. It produces shaded three-dimensional views of the terrain. These scenes show the natural features of the landscape as well as man-made objects like bridges, buildings and roads. Clouds, fog or snow can be added for extra realism.



Computer-generated scenes like this one may someday help commanders plan battlefield maneuvers.

Boeing will tailor these capabilities to handle the missions identified by ETL and MICOM. ETL's systems, for example, will generate detailed terrain graphics for tactical planning.

The company will deliver an initial software-based system to ETL in the fall of 1986. The second system, which should be ready the following fall, will transfer the image generation function from software to hardware. This shift will speed processing times from five minutes per frame to 30 frames per second. Both systems will produce complex terrain scenes from multiple data sources.

ETL scientists will use these systems as a test-bed for developing computer image generation techniques that can help commanders analyze the terrain and make tactical decisions.

"CIG may prove an ideal command and control tool," explained George Simcox, an ETL program analyst. "It gives us a way to produce terrain scenes that can be understood at a glance. These scenes eliminate the interpretation that goes into reading a map. They make it easy to identify and integrate terrain information."

Computer-generated terrain scenes could help commanders study their area of operation and plan their course of action. With computer image generation scenes, commanders could examine the terrain from any viewpoint and any location. They could use computer image generation capabilities to try out different battle tactics. They'd be able to position troops, deploy smoke, blow up dams or simulate other maneuvers and see in advance how these actions would affect the battlefield and the battle.

ETL and the Army Development and Employment Agency will test computer image generation mission planning capabilities this summer at Fort Lewis, WA. Officials plan to use prerecored terrain scenes to play out a combat scenario which will find U.S. forces erecting a line of defense along the Columbia River.

This demonstration should help the Army evaluate computer image generation technology from a command and control perspective. It will also give ETL scientists the type of feedback they'll need to move image generation systems from the laboratory to the field.

Natick Designs New Feeding System

A one-man-operated combat field feeding system, designed by the U.S. Army Natick Research & Development Center, Natick, MA, primarily for company-size elements of the newly established Light Infantry Division, will provide hot, nutritious meals to 150 people quickly and efficiently.

The cornerstone of this new system is the tray pack ration, consisting of entrees, vegetables, starches and desserts which are thermally processed. It is stored without refrigeration until needed, then heated and served.

Because the Light Infantry Division is designed to be rapidly deployed into a variety of low-to-medium intensity conflicts, such as a show of force to stablize a crisis situation and to secure a base for expansion or to reinforce an already deployed unit, its combat service support is especially austere.

Natick was tasked to determine the best method for heating tray packs to support these units. Various configurations of standard and advanced development food service equipment suitable for this purpose were analyzed, assembled, and operationally evaluated, resulting in the current design which was demonstrated and approved in January 1984.

The feeding system can be operated by a single cook. Using minimum equipment in conjunction with standard field burners and commercially available insulated food carriers and beverage containers and a pot and cradle for heating water, one person can prepare, deliver, and serve one T-ration meal a day. The Meal Ready to Eat completes the daily rations. The new system can support 150 soldiers, including two 25-man units operating at dispersed locations where central field feeding support is not available. When serving is completed, unopened tray packs may be returned to storage. Empty containers are simply discarded, eliminating the need for cleanup.

The kit can be loaded by two personnel and transported on a Commercial Utility Cargo Vehicle, High-Mobility Multi-Purpose Wheeled Vehicle 2½-ton or 5-ton truck. Thirty units have been delivered—10 to the 7th Infantry Division, 14 to the 9th Infantry Division for field evaluation and six to the U.S. Army Test and Evaluation Command. One unit was shipped to Fort Bragg, NC, for air drop tests; one unit was provided to the Quartermaster School for training purposes; and, two more were sent for possible evaluation by Army forces in Honduras. Successful testing has been completed. The system is now ready for limited type classification and procurement.

Army Examines French Surgical Unit

Late last year, following nearly a year of negotiations with the French Army, the U.S. Army Medical R&D Command, Fort Detrick, MD, procured the French Parachutists' Surgical Unit as part of its program in foreign medical materiel exploitation.

The surgical unit is an operating room in a box, designed to be dropped from a transport aircraft to support a 2,000-man fighting unit. It brings sophisticated surgical capability as close as 2,000 meters from the front, and is manned by 11 soldiers, including surgeons, nurses, nurse anesthetists, and enlisted personnel to perform various support functions.

The unit and the concept behind it fill a void in U.S. Army medical doctrine and deployable medical systems. The smallest U.S. Army medical unit with surgical capability that can be flown to the scene of combat is a division medical clearing company, which requires far more manpower, equipment, vehicles, and space aboard aircraft. The French unit is manned and equipped in the most austere fashion that still allows high quality care. Streamlined combat medical capability has been a French Army strength since the French experience in Indochina in the 1950s.

CPT Paul Paustien, MC, a surgeon assigned to the Walter Reed Army Institute of Research, who has been trained in use of the unit, described the features that make it attractive to a combat surgeon: "This unit can reach places where it's needed, including places where a medical clearing company can't go, and be operational in 90 minutes. It is light weight—about five tons—and has a low manpower requirement— 11. It can handle life-threatening war wounds—multiple, hemorrhagic, fracture, amputation—and it is self-sustaining for 48 hours."

The surgical unit is packed on pallets by airborne riggers and dropped with its 11-man crew. Experienced crews can have the unit operational in 90 minutes. The 12-bed facility has a field operating table and operating lamp, anesthesia apparatus, resuscitators, suction, and a surgical equipment sterilizer. It is stocked with a 48-hour supply of drugs and dispensable items.

After 48 hours of use, the force it supports is assumed to have moved on. The advancing unit leaves the facility in place, until logistical support forces reach it from the rear, packing it up and returning it to a base for resupply and reconfiguring for airdrop. Meanwhile, another surgical unit will have been dropped in a new location, 2,000 to 4,000 meters from the new front. Resupply and reconfiguring take 48 hours, so that the resupplied unit can be dropped just as the one currently in use is exhausted.

CPT Bart Smith, budget officer at U.S. Army Medical R&D Command Headquarters, and LTC Gerry Goethals, staff nurse at the U.S. Army Medical Bioengineering R&D Laboratory, a subordinate laboratory of the command collocated at Fort Detrick, traveled to the French Army's center for development of airborne equipment in Toulouse, France last September for familiarization in use of the unit, and orientation with French experts in its use.

In October, the French team came to Fort Detrick to instruct U.S. Army teams in unpacking, assembling and disassembling the unit. The XVIII Airborne Corps sent a 15-man team from Fort Bragg to learn about the unit, and the Medical R&D Command fielded two 11-man teams.

After the training and demonstration period at Fort Detrick, during which numerous Army, Air Force, Navy and other DOD VIPs came to look, the next step was to prepare for a demonstration drop at Fort Bragg. French experts returned to Fort Detrick in November to supervise preparation. Then the pallets were loaded on a truck and sent to Fort Bragg, for the final demonstration drop from a C-130 over the Sicily drop zone on Dec. 5.

Assembly of the Parachutists' Surgical Unit at Fort Bragg.

Army Will Field Thermoelectric Generators

The thermoelectric power generator is looking for a few good users. An inaudible power source, it can give soldiers and Marines who now use noisy gasoline-driven generators plenty to shout about.

In addition to its silence, it affords a multifuel, reliable, easily transportable, maintenance-free tactical power source for both forward areas and unattended remote stations.

The trouble is, many troops don't realize that now is the time to get their bids in for the new generators, which will start to reach the field in 1990.

One of a family of Signature Suppressed Lightweight Electric Energy Plants, the thermoelectric power generator was developed by the Electronics Technology and Devices Laboratory (ETDL) of Fort Monmouth, NJ, one of seven laboratories belonging to the U.S. Army Electronics Research and Development Command.

"Army AirLand/Battle 2000 doctrine calls for reliable, signature suppressed, mobile power sources," said Dr. Guido Guazzoni, chief of ETDL's Power Source Systems Branch. "We are developing three smaller units—100 watt, 500 watt, and 1,500 watt—that can power a host of Army equipment."

The smallest gasoline-driven generator now in use puts out a minimum of 1,500 watts, Guazzoni said. The thermoelectric power generator can run on any kind of liquid fuel. The heat that results from the fuels' combustion is converted into electrical energy using no moving parts.

The generator can also provide a clean and silent source of warm air to heat a shelter, tent, or engine/battery compartment. For example, the 500-watt version can provide approximately 24,000 Btu per hour of clean heat.

The 100-watt version weighs just 30 pounds, burns one-tenth of a gallon of fuel an hour, and is scheduled to reach the field in the third quarter of 1989. The 500-watt version weights 75 pounds, uses four-tenths of a gallon of fuel an hour, and should be fielded early in 1990. The 1,500-watt unit weights 150 pounds, burns 1.1 gallons of fuel an hour, and is to be fielded in 1992.

While the initial cost of the new generators is about two and a half times greater than conventional generators, they are far cheaper to operate and maintain on a daily basis and should pay for themselves over a relatively short period of time, Guazzoni said.

Guazzoni thinks the thermoelectric power generator is ideal for special forces and other rapidly deploying units. Unit commanders interested in seeing a demonstration of the generators may call Guazzoni at AUTOVON 995-4081 or write to Electronics Technology and Devices Laboratory, ATTN DELET-PE/Dr. Guazzoni, Fort Monmouth, NJ 07703-5302.

Unit commanders who want to make sure they receive the fielded generators should contact COL Gerald Tippins at AUTOVON 354-1614. He is the U.S. Army Training and Doctrine Command system manager for Mobile Electric Power at the Engineer School and Center, Fort Belvoir, VA 22060-5249.

Natick R&D Center Hotline

In an effort to better serve the user community, the U.S. Army Natick Research and Development Center has established a user's hotline. Natick R&D Center is the Army's proponent for food, clothing, shelters, and airdrop systems. The phone line will be located in the Operational Forces Interface Group, Directorate for Engineering Programs Management. People in this group will monitor the calls and reply to the caller.

After Natick's duty hours, callers will reach a recorder that will provide an opportunity to identify themselves, specific equipment, and the nature of their problem. The recording will be answered the next business day.

Army personnel are encouraged to use the hotline to report, discuss, or resolve problems encountered with centrally procured and issued food, clothing, individual equipment, aerial delivery equipment, tentage and rigid wall shelters. The phone number for Natick R&D Center's hotline is AV 256-5341.

Electrostatic Discharge Effects Described

William E. Jones, a packaging expert at Tobyhanna Army Depot, has developed an information program designed to overcome the harmful effects of electrostatic discharge (ESD).

Some effects of ESD are relatively benign, such as the shock you may receive when you shuffle across a carpet and then touch a metal object, says Jones. Electrostatic discharge also creates "static cling" that plagues housewives in television commercials.

However, ESD's disruptive force extends beyond mere household inconveniences. When it damages an electronics component, it contributes to a multi-million dollar problem in the electronics industry.

When ESD causes a weapon system's failure, it becomes potentially fatal to Army field soldiers. Many electronic devices, such as transistors and integrated circuits, are highly susceptible to damage by the discharge of static electricity, even at levels that can neither be seen nor felt.

Jones has written a booklet and developed a training course to inform Army personnel about methods and materials that overcome the effects of electrostatic discharge. It is a timely effort because electronic components and systems now compromise 37 percent of the Department of Defense inventory. Jones is a senior packaging specialist with the U.S. Army Materiel Command's Packaging, Storage and Containerization Center, a national activity located at Tobyhanna.

The training booklet, entitled ESD Awareness Program (The Shocking Truth), provides guidelines for Army personnel on precautions that can prevent ESD-induced failures. Electrostatic discharge causes damage in three ways, Jones says. Catastrophic failure completely destroys the component's capabilities; latent failure shortens the life of the component; and change of function alters the component's ability to perform its intended task.

ESD damage can occur in any material-handling procedure, including manufacturing, processing, distribution, installation and repair, packaging and inspection, Jones notes.

Jones has also presented an eight-hour course to approximately 850 personnel at Army installations throughout the United States. In coming months, he expects to deliver the presentation to another 1,000 to 2,000 personnel in the U.S. and overseas.

Because of ESD's pervasive presence, the course and booklet are applicable to a variety of functional personnel, including supply and maintenance personnel, quality assurance specialists and technicians, maintenance design engineers, packaging designers and specialists, and supervisory personnel.

Jones also chairs a 24-member Department of Defense ESD Program Work Group, with members drawn from all military services and the Defense Logistics Agency. The group develops standardized policies and procedures for the establishment of an electrostatic discharge control program throughout DOD. It also has drafted a DOD instruction and a Joint Service Regulation on ESD and has reviewed several packaging and electronics specifications. Future plans include improvement of materials testing methods and expansion of protective materials and equipment.

Army Orders 96 Ribbon Bridge Boats

The Army's Belvoir Research and Development Center has awarded more than $12 million to the American Development Corp. of North Charleston, SC for the production of 96 ribbon bridge erection boats. The award is the first installment of a multi-year contract for 554 boats with an option to buy 262 more.

Constructed of welded aluminum and powered by two diesel engine-driven water jets, the 25-foot boat features a 22-inch draft and a top speed of 31 mph. It can be transported to the crossing site and launched by the same vehicle that carries the ribbon bridge.

The ribbon bridge's modular design reduces the logistical problems associated with the old M4T6 bridge. It took 260 men five hours to erect a 400-foot span. With the ribbon bridge, 50 men can build the same span in less than an hour.

Delivery of the boats should begin next fall and be completed in 1989.

Awards. . .

CSTA Employee Saves Army $2 Million

Stanley M. Keithley, a senior test director in the Combat Systems Test Activity's Armor Division, Aberdeen Proving Ground, has been commended for saving the Army more than $2 million. He devised a method of disposing of armor target materials.

Many armor target materials reflect state-of-the-art armor design technology and cannot be disposed of in the same manner as conventional armor plate. Keithley's labor-saving disposal alternative was cited as saving the Army $2,001,855 in the first year of its use.

In addition to receiving a certificate of recognition from the Army Materiel Command, Keithley also has been given a cash award of $7,700. The awards are part of the Army's Value Engineering Program which analyzes Army equipment, facilities and procedures to achieve requirements consistent with lowest total cost, while still meeting requirements for quality, safety and performance.

4 Army Employees Receive Highest Civilian Awards

Four U.S. Army employees were recently presented with the two highest awards granted by the secretary of the Army to civilians, the Decoration for Exceptional Civilian Service and the Meritorious Civilian Service Award.

Dr. Clarence G. Thornton received the Decoration for Exceptional Civilian Service for his achievements as director of the Electronics Technology and Devices Laboratory, U.S. Army Electronics R&D Command, Fort Monmouth, NJ, from August 1976 to May 1984.

The citation signed by the Honorable John O. Marsh, secretary of the Army, read: "During this period, he led the Army in the development of new microelectronics, microwave, and millimeter components to improve the performance of military systems in the field. His efforts accelerated the application of advanced technology to low cost secure communications, high-resolution radar, fire-and-forget missiles, and electronic warfare systems, and enhanced the effectiveness of the Armed Forces in meeting threats on the battlefield."

Joseph J. Vervier, Miles C. Miller and Dr. Edward D. Stuebing, three civilian employees at the U.S. Army Chemical R&D Center (CRDC), Aberdeen Proving Ground, MD, received the Meritorious Civilian Service Award.

Vervier, who is CRDC's associate technical director for technology, was commended for his contributions to the renewed growth and strength of the Army's chemical posture and for his outstanding achievements in formulating an enhanced technology program for chemical and biological defense and chemical deterrence. In addition, he was honored for his planning and sponsorship of a set of new chemical defense research initiatives and co-authoring a program review acclaimed throughout the Army commands as outstanding.

Miller was cited for his technical contributions in applied aerodynamics. His achievements have significantly advanced the state-of-the-art in aerodynamics related to flight dynamics and advanced ordnance concepts. He serves as chief of the Aerodynamics Research and Concepts Assistance Branch.

Stuebing was commended for his technical contributions and leadership achievements in aerosol/obscuration science. His accomplishments significantly contributed to aerosol research and its application to military obscurant smokes for screening combat operations and to the defense against chemical and biological attacks. Stuebing is assigned to the Aerosol Sciences Division.

Conferences & Symposia. . .

Belvoir Will Host Electrical Power Fair

The Army's Troop Support Command and the U.S. Army Engineer Center will co-host an electrical power fair at Fort Belvoir, VA, June 4 and 5. The purpose of the fair is to demonstrate current and future mobile electric power systems. The fair will also provide an opportunity for industrial firms involved in mobile electric power research, development, test, evaluation and manufacturing to meet with tactical power users and developers.

Exhibits at the fair will include the Army's military standard family of generators and power units; items under development, such as low noise generators, power conditioners, and power distribution equipment; and areas of special interest and exhibits from private industry.

Military commanders, materiel developers, combat developers, communications and weapons systems contractors, and generator set manufacturers and suppliers are invited to attend. For more information, write the Troop Support Command's Belvoir Research and Development Center, ATTN: STRBE-E, Fort Belvoir, VA, 22060-5606.

Operations Research Symposium Planned

The 24th Annual U.S. Army Operations Research Symposium (AORS XXIV) will be held Oct. 8-10 1985 at the U.S. Army Logistics Management Center, Fort Lee, VA. Some 200 Army, academic, and industrial leaders are expected to participate in the event.

The theme of this year's symposium is "Army Analysis of the Future." The symposium will serve as a forum for exchange of information on significant Army analyses recently completed or in progress in some seven subject areas of emphasis, with an opportunity for creative exchange during the gathering concerning the directions needed to meet the challenges of the future.

Attendance will be limited to invited observers and participants. Papers will be solicited which address the theme of the symposium. Selected papers and presentations will be published in the proceedings.

The U.S. Army TRADOC Systems Analysis Activity, directed by Leon F. Goode, is responsible for the overall planning and conduct of AORS XXIV. For the 12th consecutive year, the U.S. Army Quartermaster Center and Fort Lee, commanded by MG Eugene L. Stillions Jr., the U.S. Army Logistics Center, commanded by LTG Robert E. Bergquist, and the U.S. Army Logistics Management Center, commanded by COL Billy C. Holland, will serve as co-hosts.

Inquiries pertaining to the symposium should be directed to Director, U.S. Army TRADOC Systems Analysis Activity, ATTN: ATOR-TRM, White Sands Missile Range, NM 88002-5502. Telephone inquiries should be made to LTC Kenneth Breeden, AUTOVON 258-3425 (Commercial 505-678-3425) or Diana Massengale, AUTOVON 258-3493/4819 (Commercial 505-678-3493/4819).

Personnel Actions. . .

Zabilansky Named Young Engineer of the Year

Leonard J. Zabilansky, general engineer at the U.S. Army Cold Regions Research and Engineering Laboratory (USACRREL), Hanover, NH, has been named New Hampshire's Young Engineer of the Year. The award was recently presented by the Joint Engineering Societies of New Hampshire in Manchester.

President of the Upper Valley Chapter of the American Society of Civil Engineers (ASCE), Zabilansky was cited for his outstanding professional contributions and achievements.

Zabilansky is active in the ASCE student chapters at both New England College, Henniker, NH, and the University of New Hampshire. In addition, he organizes an annual engineer career day for Upper Valley high school students.

He received his master's degree in engineering sciences from the University of Michigan, Ann Arbor, in 1977 and his bachelor's degree in civil engineering from Indiana Institute of Technology in 1972.

Zabilansky served in the U.S. Army from 1972-1974. He was assigned to USACRREL following basic training and stayed on as a civilian employee after his military obligation was completed.

He is a registered professional engineer in New Hampshire, and a member of the American Society of Civil Engineers.

Shipley Chosen for Senior Executive Service

John L. Shipley, deputy director of the U.S. Army Aviation Systems Command's Applied Technology Laboratory (ATL), Fort Eustis, VA, has been promoted to the Federal Senior Executive Service (SES). He is the first employee at ATL or of Fort Eustis to be selected as a member of the SES.

J. L. Shipley

Established in July 1979 by the Civil Service Reform Act, the Senior Executive Service is the personnel system for officials in grades GS-16 through GS-18, who administer the top level programs of the federal government.

As ATL deputy director and technical advisor to the director, Shipley shares the responsibility for and participates in directing and coordinating the activities of a staff of 290-320 professional, technical, and support personnel engaged in the conduct of exploratory and advanced development programs of air mobility research and development.

Shipley earned an undergraduate degree in mechanical engineering in 1960 and a master's degree in 1966, both from North Carolina State University. He received the 1970 ATL Commander's Award for Exceptional Service and five outstanding performance awards since coming to work for the Army in 1967. In 1980 and 1983, he received the Meritorious Civilian Service Award, the Army's second highest civilian award, for his contributions to Army aviation research.

He is a member of the American Helicopter Society and Sigma XI, a national honorary society, and is the author or co-author of 25 publications, reports, and technical papers.

Notice to All Active Duty 5I, 52,97 and 6T Officers

"Army RD&A Magazine" has changed its mailing practices. In the past we have used your official duty station address when mailing. Beginning with this issue, we will use the address listed in Section IV of your current Officer Record Brief (ORB). In most cases that address will be your home address.

It is our hope that this change will insure that you receive your magazines more promptly than in the past.

It is important, therefore, that if you haven't updated your ORB recently, that you do so if you wish to continue receiving the magazine without a break.

Field Exercise Data Collection

As a result of the 1979 Commander's Conference, the Army initiated an effort to standardize prescribed load lists and authorized load lists for units with the same Table of Organization and Equipment (TO&E) within the Army.

Historically, these load list computations have not considered increased wear out rates associated with combat usage and combat damage. Prescribed load lists and authorized load lists are computed based primarily on peace time demands for repair parts. These computations may provide inadequate stockage of those parts required for a unit to sustain itself during combat.

As part of the Army's Standardized Combat Prescribed Load List/Authorized Load List Program, the U.S. Army Materiel Systems Analysis Activity (AMSAA) was tasked by the U.S. Army Materiel Command (AMC) to initiate a semi-controlled, contractor-conducted, sample data collection program.

The primary purpose of this Field Exercise Data Collection (FEDC) Program is to establish and maintain an empirical data base of part replacement rates for mission essential end items from usage during intensive training and field exercises. These data are being used by AMC's major subordinate commands to update part demand frequency estimates used as input to the Standardized Combat Prescribed Load List/Authorized Load List Program.

Parts required to repair ballistic damage are determined through the Sustainability Predictions for Army Spare Component Requirements for Combat Program, conducted by AMSAA. Determination of where these parts will be stocked is in process. One option, stocking parts to repair combat damage as part of war reserves, is being studied using the M60A3 Tank as a test case.

Unlike most sample data collection programs, the field program does not concentrate on a particular type or family of equipment for an extended period of time. Instead, it concentrates on all mission essential end items (defined in DA PAM 710-2-1, Appendix J) during field training exercises.

The FEDC Program also employs a full time contracting officer's representative on site. This representative is responsible for ensuring the data collected are accurate and complete, that the data collection does not interfere with the maneuver elements of the unit, and that the maintenance and supply elements are minimally impacted by the program. He is also responsible for briefing participating units and their higher headquarters, maintaining contact with the host major command and ensuring that AMSAA is fully apprised of the field exercise status.

Since September 1982, data have been collected from units participating in training exercises conducted at major training areas in USAREUR. This maneuver unit training is considered the closest approximation to combat conditions accessible to an effort such as the Field Exercise Data Collection Program. To date, data have been accumulated on 26 battalions at the major training areas (14 mechanized infantry, nine armored, two combat engineer, and one infantry battalion).

Data have also been collected from two units, one mechanized infantry and one armored, that participated in the FEDC during REFORGER 83 and 84. USAREUR has requested that AMSAA include REFORGER 84 and 85 units in the FEDC Program. The inclusion of units participating in REFORGER exercises will significantly enhance efforts for standardized combat prescribed load lists and authorized load lists for Prepositioning Overseas of Materiel Configured to Unit Sets (POMCUS) units.

The FEDC Program is intended to support multiple Army logistics studies and is not limited to a particular type of equipment or location. Initial guidance from DA and AMC was to concentrate the FEDC on mechanized infantry and armored battalions in USAREUR. A secondary emphasis was on the same units in a desert environment, exemplified by the Army's National Training Center. Data collection at the training center was initiated in June 1984.

As sufficient data are collected on particular type units in a specific environment, other units and locations will be added to the FEDC. Plans call for collection of data from additional engineer unit activities, and signal battalions and multiple REFORGER battalions in USAREUR. In addition, approval has been granted by the Eighth Army for the data collection to expand to Korea.

As with any data collection effort, there was an initial concern regarding the impact that the FEDC Program would have on the training mission of the units involved. The FEDC operates on a non-interference basis to the maneuver elements with minimal additional responsibilities placed on each unit's maintenance elements.

Roughly one to two months in advance of a unit's scheduled visit to a training area, the AMSAA contracting officer's representative, usually accompanied by the contractor's project manager, meets with the unit commander and executive officer to give them some background on the program and provide some idea as to the impact the data collection effort will have on the unit.

One to two weeks prior to the unit's departure to the training area, an entrance briefing given by the AMSAA contracting officer's representative is attended by all unit personnel that the commander feels need to know specific details, and the entire contractor data collection team. Immediately after the entrance briefing, the contractor team begins an initial inventory to determine what equipment the unit has and the status of the equipment in terms of usage (miles, hours, rounds), age (since manufacture or last overhaul), and repair (uncorrected faults). Each unit is then asked to slightly modify the manner in which DA Forms 2404 and 2407 are completed, and to provide completed forms to the data collection team. Contractor personnel then transcribe the data to their own forms and verify the data elements. This effort continues until about one or two weeks after the unit's return to garrison at which time a final inventory is performed.

Approximately 30 days after the final inventory is completed, a portion of the team returns to the unit to acquire any deferred organizational or support maintenance action data. To date, feedback from the units has been positive; and in some instances, requests have been made by the unit commanders for the data collection effort to include them in future training exercises.

After the completion of a unit's involvement in the FEDC Program, feedback, in the form of printouts, is provided to the unit. Compilation of data for the specific unit, as well as a composite of all units involved thus far, are sent to each unit. From these outputs, information can be extracted such as end item usage and age, inventory data, maintenance action summaries, man-hour total by end item, parts demanded for each end item, top 10 parts by cost, mean units between replacements, unit and Army costs for parts used, etc. Response to these outputs has been extremely favorable and requests for additional copies have been numerous.

As stated earlier, the primary purpose of the FEDC effort is to support the Army's Standardized Combat Prescribed Load List/Authorized Load List Program. Similarly, FEDC data are being provided to the Fleet Planning Office of the Tactical Wheeled Vehicle Program Manager at the Tank-Automotive Command (TACOM) for use in the Tactical Wheeled Vehicle Useful Life Determination Program. Also, data on specific end items will be provided by AMSAA to various AMC commodity commands for use in the AMC system assessment and disciplined review programs. Special data requests can now be handled through a recently developed interactive data base available at the Edgewood Area of the Aberdeen Proving Ground.

Based on the support of DA, AMC, and USAREUR and responses of units and commands involved in the data collection effort in its initial years of operation, the FEDC Program has proved to be a highly successful and useful tool to the Army. The FEDC Program is expected to continue at least through FY87.

DEPARTMENT OF THE ARMY
Headquarters
U.S. Army Materiel Command
5001 Eisenhower Avenue
Alexandria, VA 22333

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DoD-314

SECOND CLASS MAIL

OTEA

CONTINUOUS AND COMPREHENSIVE EVALUATION... A NEW APPROACH